

DIV. OF FISHES

THE UNIVERSITY  
OF MICHIGAN

# COMMERCIAL FISHERIES *Review*

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COVER: Giant turtles at Chimbote, Peru. Caught locally, they are brought to market and left on their backs to die.

(Photo: FAO/S. Larrain)

# COMMERCIAL FISHERIES

## *Review*

A comprehensive view of United States and foreign fishing industries--including catch, processing, marketing, research, and legislation--prepared by the Bureau of Commercial Fisheries.



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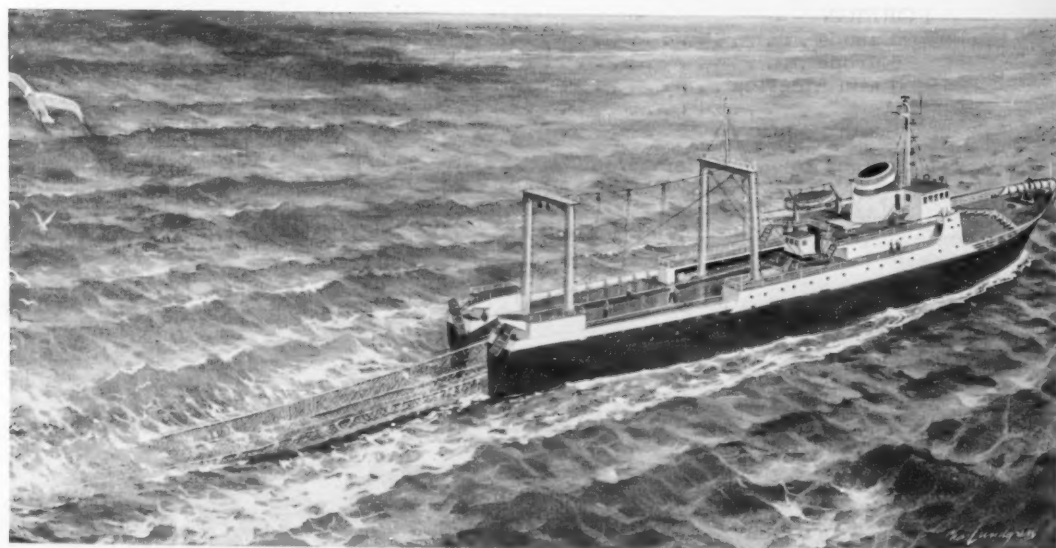


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(Photo: J. Puncoschar)



## LARGEST U. S. FISHING VESSEL CHRISTENED IN BALTIMORE

A \$5 million, 297-foot, 3,120-ton freezer stern trawler--the SEAFREEZE ATLANTIC--was christened at the Maryland Shipbuilding and Drydock Co. in Baltimore on September 21. Nearly as long as a football field, she will be the largest fishing vessel to fly the U. S. flag and be able to compete with the latest foreign vessels. Her sponsor was Mrs. John A. Volpe, wife of the Massachusetts Governor.

A sistership, the SEAFREEZE PACIFIC, will be christened in December.

Owner of the vessels is American Stern Trawlers, Inc., a subsidiary of American Export Industries. The vessels are being built with the aid of a subsidy provided by the U. S. Department of the Interior under the 1964 Fishing Fleet Improvement Act. BCF administers the subsidy program.

The SEAFREEZE ATLANTIC will be based in Gloucester, Mass., and fish the Grand Banks and off Labrador. The SEAFREEZE PACIFIC will fish off the Pacific Northwest from her West Coast base.

### What They Will Do

The vessels will be able to stay at sea 2 months and process their catch. Each can

catch, clean, package, and freeze 2 million pounds of fish on one voyage. Assembly-line equipment "will sort, head, gut, wash, fillet and skin the catch from the ocean floor and have it packaged and frozen in a matter of hours." Refrigerated holds will maintain packaged fish at  $-20^{\circ}$  F.

The trawlers are designed to use nearly everything they catch. Inedible or trash fish, and waste from the cleaning process, will be converted to fish meal and fish oils.

### Well Equipped for Fishing

Both ships are equipped for both bottom and midwater trawling and can work in bad weather. Sonars will locate and track fish schools and warn of obstructions on the ocean floor. Deck machinery will exert a 20-ton pull on the trawl. Each vessel will carry 6 of the largest nets ever made. The bottom-sweeping net is 600 feet long, 60 feet high, and 120 feet wide.

### The Sisterships

The trawlers are powered by 3 General Motors diesel engines generating 3,200 shaft horsepower. They will cruise at 14.4 knots, carry a crew of 56 in air-conditioned cabins, and be able to cover 26,000 miles.



# UNITED STATES

## U. S. Vessels Make Good Tuna Catches in E. Atlantic

At least 8 U. S. vessels were in the Eastern Atlantic in second-half September making good catches: about half yellowfin, half skipjack. Landing capacity loads at Abidjan, Ivory Coast, Africa, were the seiner "Caribbean," 700 tons of tuna, and the "San Juan," 1,000 tons.

Early in September, the "Nautilus" and "Bold Venture" landed capacity loads at Tema, Ghana (probably total of 1,800 tons).

Yellowfin were reported large: some up to 100 lbs. each.

### The Fleet

Total capacity of the 8 vessels is 6,800 tons. With fishing good in the Eastern Atlantic and poor in the Eastern Pacific, more vessels were expected to move into the Atlantic. In 1967, only 3 vessels were there.

Landings were largely transhipped to Puerto Rico.



## EDA Aids Fishing Industry

Between August 1965 and June 1968, the Economic Development Administration (EDA) helped finance 48 projects to improve or expand port, harbor, and dock facilities.

Individual projects ranged from a grant of \$10,125,000 to finance a wharf and transit shed, and to develop land, back-up land, container yard, and access roads in Oakland, Calif.--to a \$2,000 feasibility study on construction of a town dock and marina in Harborside, Town of Brooksville, Maine.

EDA invested \$8,402,000--65% of the total cost--in 13 projects developed specifically to benefit the commercial fishing industry.



## 1968 Import Quota for Tuna Canned in Brine

The quantity of tuna canned in brine that may be imported into the U. S. during 1968 at the 11-percent rate of duty is limited to 66,985,048 pounds. This is about 3,189,764 standard cases of 48 7-oz. cans. The limit is about 3.6 percent less than the 69,472,200 pounds (about 3,308,200 cases) in 1967; 2 percent over 1966's 65,662,200 pounds (about 3,126,771 cases); 1.4 percent greater than the 66,059,400 pounds (about 3,145,685 cases) in 1965; and 10 percent over the 60,911,870 pounds (about 2,900,565 cases) in 1964.

### 22% Duty Above Limit

Any imports of tuna canned in brine over the 1968 quota will be dutiable at 22 percent ad valorem under item 112.34, Tariff Schedules of the U. S.

The 1968 quota is based on the U. S. pack of canned tuna during the preceding calendar year (1967), as reported by the U. S. Fish and Wildlife Service.

### First Quarter Imports

U. S. imports of tuna canned in brine during Jan. 1-Mar. 30, 1968, were 14,616,675 pounds (about 696,032 standard cases). These are preliminary data of the Bureau of Customs, U. S. Treasury Department.



## Pair Trawling on Georges Bank Presents Hazard

U. S. fishing vessel captains are being warned of a hazard connected with pair trawl fishing on Georges Bank by foreign fishing vessels.

Pair trawlers use a single trawl, towing the net between them. In most cases, the vessels have a nylon line running from bow to bow. The trawlers proceed on a parallel

course about 150 yards apart. Fishermen who observe vessels operating this way should assume that they are pair trawlers and avoid running between them.

#### Few Signals Displayed

Although the recent London Fisheries Policing Conference agreed to have pair trawlers use the international code signal "T," a red, white, and blue vertically striped flag during daylight, and crossed search lights focused ahead of the vessels at night, few if any pair trawlers display these signals.

Radar should be watched closely during low visibility for parallel-course vessels. They could be pair trawlers.



#### Fur Seals Discovered Off California

A breeding colony of fur seals (*Callorhinus ursinus*) was discovered on San Miguel Island off the California coast on July 20 by Dr. Richard Peterson, University of California, Santa Cruz, and Robert DeLong, Smithsonian Institution, Washington, D. C. It is the first confirmed record of the northern fur seal breeding on any eastern Pacific island other than the Pribilofs.



Breeding colony of northern fur seals discovered on San Miguel Island, about 30 miles off Point Conception, California.  
(Photo: National Park Service)

#### The Colony

The colony had about 100 animals, including one adult male, about 60 females, and 40 pups. About 35 of the females were checked for tags and checkmarks. One had a tag applied on the Commander Islands; 4 or 5 had been tagged on the Pribilof Islands.

#### Acoustical Workshop Slated for Seattle in November

An Acoustical Workshop will be held at BCF Exploratory Fishing and Gear Research Base in Seattle, Wash., Nov. 25-27. It will be open to the scientific, academic, and industrial communities.

Major emphasis will be placed on equipment, techniques, and applications for acoustically determining species composition and magnitude of living and aquatic resources.

#### Open House On 'Cobb'

During Nov. 18-22, participants will be able to board BCF's John N. Cobb to see the recently installed Triton acoustical counting system. One of the system's developers, Ron Mitson of Britain's Lowestoft Fisheries, will demonstrate its operation and discuss the procedures.



#### AEC Aids in Columbia River Thermal Study

The Atomic Energy Commission is joining Interior Department's Federal Water Pollution Control Administration and BCF in a study underway since February to determine whether hot-water discharges are polluting the Columbia River.

The study of the effects of thermal discharges from nuclear power plants and other sources is scheduled for completion in July 1970. One purpose is to find out what effect the heat discharges have on the river's ecology--and particularly the salmon and other fish in this stream.

#### 1970 Report

Representatives of the 3 Federal agencies have agreed on research steps needed to find the effect of temperature on cold-water fish in the Columbia. Each agency has part of the research responsibilities.

"Although the final report to be issued in 1970 will be a team effort of the 3 agencies, the FWPCA has principal responsibility to



complete the final report," Interior Secretary Udall said.

The study also will provide needed information for the mathematical models developed to evaluate and predict temperatures in the Columbia under a variety of conditions.



## Biologists and Engineers Discuss Thermal Pollution

About 200 people attended a national symposium on thermal pollution in Nashville, Tenn., Aug. 14-16, cosponsored by the Federal Water Pollution Control Administration and Vanderbilt University. The participants represented electrical utilities, the U. S., States, and universities.

They discussed temperature in the aquatic environment and its relation to "water quality standards, biological requirements, mixing of heat in natural waters, modeling heated water discharges, design of cooling towers, and the economics of cooling water discharges."

### Need for Meeting

Observers said that the need for communication between biologists and engineers was evident at the meeting. Biologists are being asked to provide estimates of critical temperatures for aquatic organisms. The estimates will be difficult to get in many cases. And the engineers--to keep waste out of the natural environment--will have to turn to very expensive and relatively untested devices, such as cooling towers.



## U. S. Families Asked About Their Seafood Tastes

The first questionnaire in a year-long survey of U. S. seafood-eating habits is scheduled to be distributed in October. BCF awarded a \$95,400 contract to Market Facts, Inc., of Chicago, to conduct the survey. Biweekly, a representative sample of U. S. households across the Nation will report the type of fish and shellfish it buys and how it prepares them. This information will be related to size, age,

sex, income, and religion of household members, and occupation of household head.

BCF will use this information in its continuing study of factors that influence the eating of fishery products.

Study results will be provided to the fishing industry and processors. The information should help them to better serve the public.



## Shad's Return to Susquehanna Is Assessed

A century ago, a man heading for California loaded into the train's baggage car milk cans with live small shad he had taken from New York's Hudson River. When he got to California, he released them into the Sacramento River. Many years later, the descendants of those fish were returned to the Eastern Seaboard and, in 1965, they became part of a Federal-State study to determine whether shad could be restored to the heavily dammed Susquehanna River.

### The Report

The study team found that "shad eggs can hatch, larvae can develop, and juveniles can survive and prosper in most of the Susquehanna River." The team's findings are contained in a 60-page booklet recently issued by the Bureau of Sport Fisheries and Wildlife.

The report states that the next questions to be asked are whether enough adult shad with a strong urge to migrate upstream are available, whether the designed fishways would attract fish, and whether adults would move efficiently upstream through reservoirs. "The broad question of the total desirability of installing one or more fishways on the Susquehanna... lies with the separate State and Federal agencies."

### Power Companies Aided Study

Cooperating in the study were BCF, New York Conservation Department, Pennsylvania Fish Commission, and Maryland Board of Natural Resources.

Power companies contributed \$196,500 for the study.

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## AQUACULTURE: Its Status and Its Potential

Farming the sea--aquaculture--can make an important contribution to a global war on hunger and to the domestic economy of the United States.

This conclusion is reached by two researchers, Prof. John E. Bardach, University of Michigan, and Dr. John H. Ryther, Woods Hole Oceanographic Institution (Mass.), in their report, "The Status and Potential of Aquaculture." The report was prepared for the American Institute of Biological Sciences under contract to the National Council on Marine Resources and Engineering Development (Marine Sciences Council).

It is published in 2 volumes: Volume I deals particularly with invertebrate and algae culture; Volume II with fish culture.

Prof. Bardach and Dr. Ryther state: "Immediate benefits to the United States arising from expanded practice of aquaculture here would be the increased production of high quality food items now considered luxuries because of limited supplies, and the economic rejuvenation of a sector of the fishing industry (mollusca shellfish) now severely depressed."

The two experts emphasize that the United States has the scientific skills needed to make major contributions to aquaculture--but at present no single agency of the U. S. Government is responsible for coordinating efforts in this field, and private activities too are scattered.

They believe that aquaculture--particularly the highly efficient and productive herbivorous forms--can help to alleviate world hunger. This can be achieved by: applying recent scientific and technological advances to existing practices, particularly in the world's developing countries; fashioning new methods or techniques with the aid of such disciplines as genetics, nutrition, pathology, ecology, and engineering; and opening new geographical areas to aquaculture.

The major points of the Bardach-Ryther report are summarized below.

### GENERAL PRINCIPLES OF AQUACULTURE

The intensive culture of aquatic organisms--in contrast to capturing them from

untended stocks--is carried out in many areas of the world. It is more prevalent and successful in fresh and brackish waters than in the sea itself. But Japan, the USSR, and Great Britain are attempting genuine marine husbanding.

Existing data do not reveal the "world tonnage of fish, invertebrates and aquatic plants produced by such active interference of man in the natural life cycles of the organisms or in the management of their environment." The authors estimate that total tonnage produced by aquaculture may lie between 5% and 10% of total world fish catch. They quote an estimate that, for fresh and brackish water alone, the consistent use of the best techniques could raise fish tonnage produced by aquaculture 3 to 5 times--to a round 30 million metric tons. Intensive aquaculture in "waters of full marine salinity is in its very infancy."

### Few Fishes Raised

The 25,000 species of fishes form the largest class of vertebrates, but very few of these have been raised by intensive husbandry. Even fewer species have been domesticated like some mammals and birds. And still fewer aquatic invertebrates have been cultured successfully. Yet, the authors state, it is possible today with intensive care to produce "significantly larger amounts of high-grade animal protein per unit of inshore or freshwater surface than on fertile dry land."

"Artificially fed fish (carp) increase in weight 2-2.5 times more than cattle or sheep" in terms of increase per unit weight of animal per unit weight of food consumed. The oysters on 1 acre of sea bottom have access to the food in thousands of acres of water flowing past them. In principle, "a few hundred pounds of beef cattle can be raised in an acre of very good pasture"--but a ton or more of fish and a hundred tons of shellfish may be cultivated in the same aquatic area.

### WHICH ORGANISMS TO CULTURE?

The authors examine the biological properties of organisms that would make them most suitable for intensive culture:

- They should reproduce in captivity or semiconfinement--or be easy to manipulate for the purpose of producing offspring. The

Pacific salmon dies after spawning, eliminating the need to keep spawners alive; this makes it easy to handle one stage of the culture operation. If breeding is not easy, the larvae or young should be easily available for gathering.

- "Their eggs or larvae should be hardy and capable of being hatched or reared under controlled conditions."

- The food needs of larvae or young should be satisfied by operations that can increase their natural foods--or they should be able to take prepared feeds from their early stages.

- They should gain weight fast and nourish themselves entirely or partly from foods that are available in abundance and can be supplied to them cheaply--or can be readily produced or increased by man where the cultured species lives.

The authors say there are few aquatic organisms that would not have problems with 1 or more of the 4 qualities; only a handful combine all these attributes.

#### PROBLEMS OF AQUACULTURE

Several problems are commonly encountered in aquacultural practices:

- The many subtle qualities of the environments--such as temperature, salinity, oxygen, etc.--determine whether an animal or plant will reproduce at all.

For most marine organisms, these conditions are not known exactly. Only in a few cases has it been possible to duplicate the necessary conditions. But these problems are less difficult than they seem at first. Many aquatic, especially marine, organisms produce enormous numbers of eggs and larvae. In some cases, these larvae can be collected from nature before they die in vast numbers and can be raised in culture (e.g., milkfish). However, this practice prevents mass selection for desirable characteristics--the very foundation of animal husbandry--because the parents with these characteristics are not available.

Also easing the problems of aquaculture is a relatively recent practice that already has had far-reaching effects on fish culture: injection of pituitary hormones that ripen the fishes' gonads and allow forced and controlled

spawning of species--e.g., grass carp and possibly mullet--which had not been propagated artificially before.

- Unlike higher forms of life, many fish and most invertebrates have larval forms that bear little resemblance to the adult. "Culture of such organisms through their larval cycle requires basic knowledge, facilities, and techniques which differ entirely from the practices involved in growing the adult." Often, rearing the larvae is by far the most difficult part of successfully culturing a species. "For example, the spiny lobster has not yet been successfully brought through its 20-25 larval stages in culture."

- "Often the principal objective of aquacultural enterprises is to grow as many organisms in as small a space as possible. This crowding produces problems: feeding, growth, metabolism, behavior, morphology, accumulation of toxic wastes in the water, rapid transmission of disease and parasitism, and often cannibalism. The last is the main obstacle to the culture of many crustaceans, notably the American lobster."

#### AQUACULTURE'S PROGRESS

Despite these difficulties, the authors state, aquaculture has made important progress in many parts of the world. The incentive is profit. The species selected, the luxury foods, bring the highest price to the culturist. While this seems inconsistent with the goal of easing the world protein deficiency through aquaculture, it is not necessarily so. When luxury foods become sufficiently abundant, they stop being a luxury. A high-priced market may be the initial incentive to culture a species and may justify research and development funds.

The important factor, the authors emphasize, is not the product's status or market price. It is production cost in dollars and/or in protein food. This is one of aquaculture's principal problems. The reason is that the species in culture, excepting molluscs and several fish species, are predominantly carnivores or omnivores 2 or more levels in the food chain above the photosynthetic base. Each step up the ladder means a loss of about 90% in converting food to new animal tissue.

This conversion can be done economically where the product is extremely valuable and the food may be obtained cheaply. In Denmark,



for example, small herring and trash fish from the North Sea are fed to rainbow trout. In Japan, shrimp are fed small shellfish, fish, and commercially caught shrimp of low market value.

The authors report great progress in compounding land-produced waste food stuffs, fortified with animal proteins and vitamins, into cheap and readily available food for fishes. These practices are sometimes comparable to the mechanized, mass production of chickens, fish meal, and other prepared foods in the U. S. and Europe. In modernizing the chicken industry, the chicken was reduced from a luxury food to an inexpensive, staple, meat product.

To achieve the goal of increasing the world's protein supply, the herbivorous species should be used. They feed at the photosynthetic base of the food chain. There is only one step in the conversion from plant matter to animal flesh. And, in contrast to land forms, they use microscopic plants that still remain unharvestable and unuseful to man. The ways to increase them above their natural yields--insofar as they are the food of animals raised with aquacultural practices--are an integral part of aquaculture.

The authors state that "almost staggering amounts of certain shellfish can be produced even with existing techniques." A 1,000-square-mile area--the size of Long Island Sound--if ecologically suitable, could produce each year 3 times as much mussel meat as the world's total fish catch. The authors point out, however, that this example is specious unless such areas are available for aquaculture. "Thus, an evaluation of the potential of aquaculture must include not only the ecology of the organism and technical aspects of its culture, but also consideration of geographic, demographic, sociological, and economic facts as well."

#### INTENSITY OF AQUACULTURE

To gain estimates of the ranges of flesh production from aquaculture, it is more meaningful, the authors say, to establish categories showing the intensity of culture rather than to divide the practices into fresh, brackish, and salt-water practices.

The following are the author's arrangement of categories by "ascending intensity" of labor and capital input and, by and large, by increasing yields:

- Transplant species from poor to better growing grounds: in Denmark, North Sea plaice to selected fjords; introduce species into new environments along with selected food organisms of these species--as in Soviet Union. "...this method of extensive culture shows little economic promise, or has, at best, qualified success, locally."

- Stock hatchery-reared juveniles to augment and replenish natural stock. This is done with various anadromous salmon species. New hatchery techniques give this practice a more favorable cost/benefit ratio.

- Enclosures to retain organisms, or devices on which they are put--either by themselves or after they have been collected: prawns in Malaya, mullets and eels in Adriatic "Valli" culture. The water in the enclosures is not fertilized, nor are the animals fed; mollusc culture and Japan's culture of marine algae are in this category.

- Fertilize ponds or enclosures shut off from the sea: milkfish in Southeast Asia; some carp culture in Northern hemisphere; some Tilapia culture in Africa and Near East; and some shrimp culture in Southeast Asia.

- Enclosures and ponds in which the water is fertilized and more food is supplied to the animals: catfish in U. S., most carp culture in Northern hemisphere, some milkfish and mullet culture, and culture of Chinese carps in China and Far East.

- Enclosures, often cement, in which the animals are raised only by extraneous feed. This compares somewhat with intensive chicken-raising methods in U. S. and Europe. Volume of flow, not surface, is important in this category, which includes: Salmonid--trout and salmon culture in U. S. and Europe, shrimp in Japan, carp and eel in Japan, and experiments with plaice and sole in Great Britain.

#### YIELDS

Intensive pig farming in developed nations produces around 25 tons of live pigs per man-year; an oyster farmer can raise 40-60 tons (shells excluded) per year. The average Danish trout farm, with 2 or 3 men, produces about 40 tons of trout a year. The sewage ponds of the Bavaria Power Co., near Munich, can produce 100 tons of carp from about 200 hectares of water. Three men tend the ponds and fish, so fish production per man-year would exceed 30 tons.

On a well-designed trout farm in Idaho, in the U. S., with enough water, one man may produce over 100 tons of fish a year; if the fish are dressed, production per man falls to 40-50 tons. The revenue per weight unit to the producer "may be reasonably compared to that derived from a weight unit of pig flesh."

Yields also depend on the organism and its position in the aquatic food chain. Algae and those animals that feed directly on the algae--molluscs, milkfish, mullet--generally produce greater yields per unit of area than species at higher trophic (nutrition) levels. This is because of their "ecologic position and their greater efficiency in creating (algae) or utilizing (herbivores) the primary products of organic synthesis."

#### AQUACULTURE IN A FOOD ECONOMY

It is said that aquaculture deals with luxury foods rather than staples. It is true for certain organisms and certain economic conditions (the U. S., for example). But in land-poor developed countries--Japan and, to some extent, Israel--beef is more expensive than most cultured fish. Land-poor countries, or those with soil-fertility problems and low protein supply, look to aquaculture for some staple proteins: Java with carp and milkfish culture, both Chinas with pond culture, and large parts of Africa with rapidly rising pond culture, mainly for Tilapia.

Even the bare beginning of fish culture--establishing enclosures--often leads to increased output per human unit of effort. Over 5% of Japan's total fish catch comes from coastal areas, where various fish species are allowed to enter as fry or young but cannot leave until they are harvested.

All aquaculture is done for profit, which sometimes is substantial: algae culture in Japan, oyster in Brittany, and trout and catfish in U. S. Where the operation is designed to produce more meat than the family needs, profits can be estimated. They range from 10%-15% on invested capital in low-intensity milkfish culture in Philippines to near 20% with better management in Taiwan's milkfish ponds, to 30% or more on Malayan mixed pig and fish farms. "The situation is comparable in the culturing of aquatic invertebrates."

The authors believe that aquaculture today, with a few minor exceptions, is where agriculture was 50 or more years ago. They go

on to examine the potentials for aquaculture's expansion through advances in methods and extension of area.

#### EXPANSION OF AQUACULTURE

Even in Japan, where it is being developed, true farming of the sea, with the exception of oyster culture, is still in its infancy. However, a trend toward rapid expansion of sea fish culture is apparent: in 1965, total production of yellowtail in Japan's Inland Sea was 65.6 thousand metric tons; over 80% of this was from cultures--net-cage-raised fish. In 1966, about 20 million young captured fish were raised in net enclosures floating in the sea, while the comparable figure in 1956 was about 200,000. Research on controlling the spawning of this species is pressed by Japanese government agencies. BCF biologists report recent successful pilot experiments with hatching and rearing of related species.

Brackish and freshwater aquaculture is more widely practiced--and also shows a wide range of production efficiencies. Raising milkfish in the Philippines now is done mostly without fertilization and/or extraneous feeding. Annual yields per hectare vary from 25 to 500 kilograms, depending mostly on soil but also on grower's efficiency. In Taiwan, with less-favorable colder climate, pond fertilization, control of competing animals such as insect larvae, and application of some extraneous food have produced annual per-hectare yield of over 2,000 kilograms.

#### FAO Projection

In 1966, FAO fisheries biologists examined the opportunities of upgrading management techniques as they apply to very extensive, semi-intensive, and most intensive methods of fresh and brackish water fish culture. Then they made a projection of aquacultural possibilities. Their estimates range between 5-fold and 15-20-fold increase as a possible goal to attain within the next 35 years. They believe that present average production could be raised to those levels with today's best-known fish-production techniques.

Aquaculture could be expanded by bringing into culture suitable areas not now used. No global assessment of these areas has been attempted, but FAO plans to promote it. The use of the entire potential swamp area would produce a very large yield.

The recent development of hatchery rearing techniques for invertebrates--molluscs, freshwater and marine shrimp--has opened opportunities for aquaculture in undeveloped areas. There, estuaries and coastal lands suitable for pond construction abound, but the major restraining factor is lack of organisms. "The most immediate expansion of aquaculture can be achieved by combining hatchery production with low-to-moderate intensity of cultivation practices in such regions."

As techniques improve, it becomes possible to get greater yields from less area. This is taking place in advanced, but land-poor, countries.

The catch of marine fishes has doubled (roughly) in each 10-year period since 1945. The increase was produced with much new technology and the tapping of large virgin resources: Peruvian anchovies and Soviet and Japanese fishing efforts. But ocean fishing has "finite limits," and the authors speculate that comparable large investments in aquaculture "may yield more returns per dollar more quickly than those put into the exploitation of untended stocks."

#### CHECKS ON AQUACULTURE'S GROWTH

The best control over an aquacultural enterprise is ownership of the area by the operator. Aquaculture also is conducted on public lands (brackish-water fish, oysters) and here leasing arrangements have to be worked out. The U. S. oyster industry, unlike the Japanese and European, is the best illustration. In the U. S., as many oysters are produced from the 185,000 acres of leased beds as from the 4 million acres of public oyster grounds. The average yield from the latter is 1/600 that of intensively cultivated leases in the U. S. and 1/5000 the average yield from Japan's Inland Sea, where all oyster-producing areas are publicly owned but privately controlled.

There are conflicting uses of public lands: for recreation, conservation, subsoil exploitation, aquaculture, etc. How the lands are used should be determined on the basis of benefit-to-cost ratios, where possible. Few such data exist for aquaculture. "The greatest need for pertinent figures exists in developing countries, but even such advanced nations as the USA do not have adequate data about the rentability of aquacultural enterprises, especially in the brackish water realm."

The problem of pollution in aquaculture falls into the same category of checks on aquaculture's development as the conflicting uses of surface areas and the supply of water. Water is a public resource needed for communities and industries--as well as for growing fish and shellfish.

In some developing countries that have aquacultural potential, the economy's private sector cannot promote this method of increasing protein supplies. Government aid is needed.

#### TECHNICAL CHECKS ON AQUACULTURE

An increase in aquacultural yields depends on upgrading present procedures and on more basic and applied research. To adopt the best-known practices, some legal, political, and organizational curbs must be removed. More research is needed in important areas of biology and technology. The problems of aquacultural biology can be divided into those concerning the animals and those concerning their environment.

#### Problems of Biology

- Animals that become captives undergo a decrease in environmental stimuli and are subjected to new ones. As a result, reproduction often is impaired. The authors state: "A thorough knowledge of the animal's biology and ecology is necessary before their reproductive functions can be manipulated satisfactorily; in most cases of semi-intensively cultured species this knowledge is not extant and should be sought."

Means should be found to bring about the simultaneous readiness for reproduction of males and females of the species. Often, males produce sperm but females will not release their eggs. Manipulating the environment has been successful here: increasing the water flow while raising or lowering temperature.

With fresh and brackish-water fish, the most important technique is hypophysectomy--injection or implantation of pituitary gland material from the same or related species. Extension of this work to more species, milkfish and marine species, for example, would produce useful results. U. S. scientists, because of their competence in endocrinology, "could play a strong role here."

● For the many kinds of aquatic organisms that go through several larval stages with selective food habits, an optimal, economically produced food has to be found for each species and often for each larval stage. Engineers and biologists must cooperate on this problem.

● Genetic selection and breeding of desired varieties is an important area. Presently, this approach is possible only with aquatic organisms that propagate under controlled conditions, and whose larvae or young are easy to raise. Among invertebrates, pilot-scale selective breeding has been tried with oysters and shrimp. But only carp and trout have been developed commercially into varieties. Selective breeding may soon be possible with mullet and Tilapia. Little is known about basic fish genetics; the genetics of molluscs, crustaceans, and marine algae is a virgin field. The U.S. is behind other nations in this area.

● The more intensive the aquaculture, the closer together the animals are raised. Disease organisms are transferred more readily. The study of parasite life cycles and disease prevention is an old concern of fish raisers. Most knowledge has developed about carp, trout, and oyster diseases, while parasites that attack other fishes and invertebrates are less well known. The study of parasites and diseases of aquacultural organisms is important where intensive aquaculture is practiced.

#### Problems of Aquacultural Ecology

● It is possible to increase the yields of water by operations comparable to the use of fertilizers, tilling, etc. Soil science is a vast field, but the amount of corresponding basic information on the interaction of pond, sea, lake, or river bottom with the overlying water is very slight.

"Practically nothing is known of the basic chemical processes that are altered or influenced when one fertilizes brackish waters. . . . Required also is research in the basic chemistry of the water--substrate interface, the circulation of nutrients, their cycles, etc."

● In aquaculture, the nutrition of the cultured animals and the fertilization of the water-substrate complex are closely related.

Improving both simultaneously brings optimal yields. But, in many cases, natural diets are incompletely known--and the digestive physiology of invertebrates and herbivorous fish has hardly been investigated. Pond-culture practices often are conducted with little understanding of what the animals are eating. Basic research in nutrition physiology should be promoted. To manufacture or obtain cheap and adequate diets may mean culturing such aquatic animals as molluscs or insect larvae--and compounding in moist or dry form plant-based, enriched, artificial diets. "Feed research for pigs, cattle and domestic fowl is incomparably more advanced than that for aquatic animals."

● A pond or sea enclosure, in contrast to a field, is a 3-dimensional growing space: some animals feed on bottom, some on plankton in midwater, and others on surface, perhaps on extraneous material. China has combined species using these different feeding habits. Other countries that tried them produced greater yields than when raising one species alone. The combined culture of fish and crustaceans also raised yields. The raft-culture of shellfish off the bottom, in a "truly 3-dimensional environment," produces much greater yields than when conventional bottom culture is practiced. These techniques can be improved.

In marine and brackish water, the cultivator must control those competing species he does not want--from insect larvae of small invertebrates to large predators. More applied research is needed here.

#### Technology

● The advanced nations have great civil engineering capabilities and experience in the economical use of labor-saving devices. These skills are needed to build fish-holding structures geared to local soil and water conditions.

Agriculture was revolutionized by the use of machinery. Aquaculture (excepting pilot research plants) is where agriculture was before machinery was invented. Engineering design and development must be applied to aquaculture's needs. This would raise production per unit of effort--even when it did not raise yields.

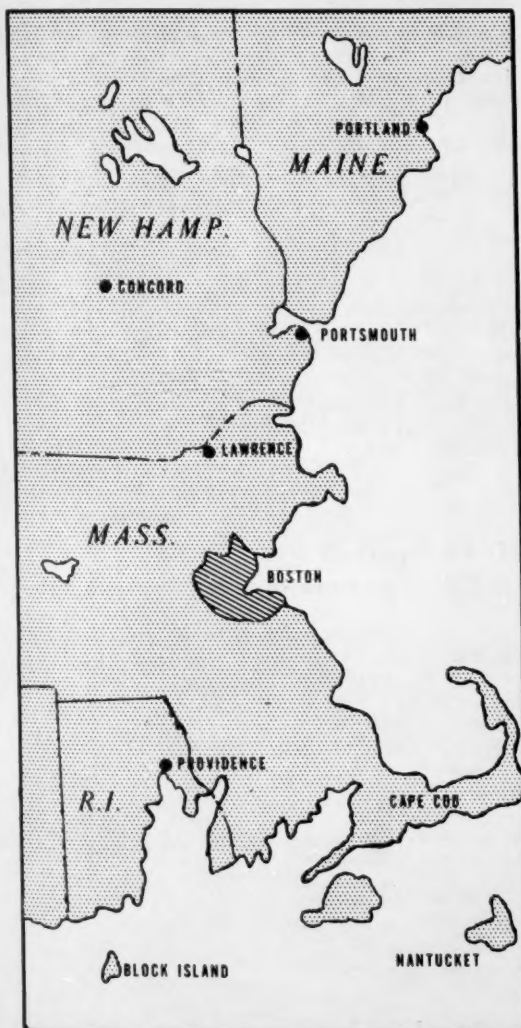




## OCEANOGRAPHY

### Bathymetric Map of Sea Bottom Off New England Being Prepared

The most detailed bathymetric map of the sea bottom off New England is being compiled by cartographers of ESSA's Coast and Geodetic Survey (CGS). It will include the floor of Boston Harbor.



The map will cover the area from Cape Cod, Mass., to Portland, Me., and up to 53 miles seaward off Boston.

The map will cover 6,800 square statute miles of ocean bottom extending from Cape Cod, Mass., to Portland, Maine, and up to 53 miles seaward off Boston.

#### One of Series

It is one of a series planned by CGS for the Continental Shelf, an area about 862,000 square statute miles of submerged land off the U.S. The maps are designed to aid Federal, state, and industrial interests explore and develop the area's resources. Their economic development depends heavily on adequate sea bottom maps; few exist at present.

#### 100 Surveys of Area

The mapping, which will take several months to complete, portrays the sea bottom at 5-meter (17-foot) intervals. The cartographers use depth data represented in more than 100 hydrographic surveys of the area conducted by the ESSA agency over 114 years. The map is expected to be released within a year.

Depths shown will range from a few feet off the coast to over 600 feet about 53 miles east of Boston. The bottom of Boston Harbor will be shown in detail for the first time.



### Seek Underwater Obstructions to Delaware Bay

The Coast and Geodetic Survey has begun a two-month search for hazards to navigation in the approaches and entrance to Delaware Bay. The wire drag vessels "Rude" and "Heck," working as a team, will probe for sunken wrecks and other pinnacle-like obstructions in the heavily traveled sea lanes leading into the Bay.

#### Methods

The vessels will first sweep the anchorage area inside the Bay entrance, with a submerged wire towed between them, and then sweep the approach to the anchorage area and sea lanes. Rude and Heck, the only ships of

their kind, use a method perfected more than a half-century ago. The steel wire between them, suspended horizontally from surface buoys, is normally towed 35 to 60 feet below the surface. When the wire catches on an underwater obstruction, it tautens, and the surface buoys form a letter V. Exact location of the obstruction and depth over its highest point is then determined.



### Search for Navigational Hazards Off Maine, N. J., Maryland

A 4-month investigation is being conducted for navigational hazards in the offshore waters of Maine, New Jersey, and Maryland by the Coast and Geodetic Survey. The task that began in August is to update current nautical charts.



### Survey Alaska's Lower Cook Inlet

A hydrographic survey to aid Alaska's economic development is being carried out in Cook Inlet by the Coast and Geodetic Survey's "Pathfinder." It is being made in McNeil Cove and Bruin Bay in western Kamishak Bay, Cook Inlet.



The Pathfinder, one of the larger ocean survey vessels.

The 4-month survey will benefit the increasing marine activity and economic development of Cook Inlet, one of Alaska's important waterways.



### Internal Waves Under Study

A 15-day probe of internal waves, mysterious ocean phenomena that cause unusual behavior in underwater sound, is being made by oceanographers of ESSA and the University of Washington.

Internal waves, found in all the world's oceans, are at times larger than surface waves. Internal waves 270 feet high have been measured in the Indian Ocean, while the highest surface wave ever reported was 112 feet. Sufficiently widespread to be a significant factor in many ocean processes, they may serve as "an effective mechanism for transferring energy" from the surface into the deep ocean. They may also affect underwater acoustics, communication, detection, location, and mapping.

#### 80 Miles Off Washington

The investigation site is about 80 miles off Washington and British Columbia, where the continental shelf slopes down into the deep ocean. The oceanographers are testing a theory that some internal waves are generated by the surface tide at the end of the continental shelf. Internal waves are sometimes called internal tides.

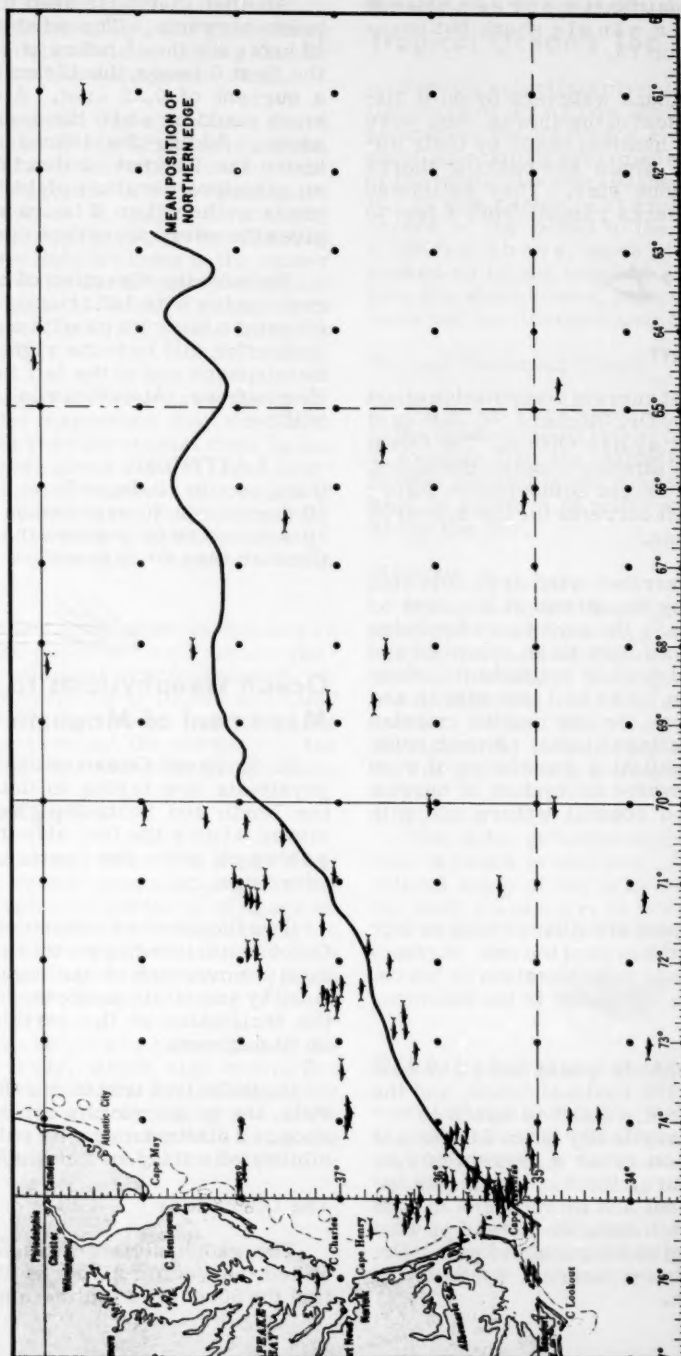


### Navy Flyers Watch Sharks in Gulf Stream

Airborne oceanographers of the U. S. Naval Oceanographic Office have been watching closely the wolves of the sea--sharks--along the northern edge of the Gulf Stream. The Oceanographic Office's publication, "Gulf Stream," states: "The Navy's interest in sharks stems from the threat they pose to survival at sea. . . . In addition, sharks, or organisms upon which they prey, may interfere with underwater sound-ranging operations" used by the Navy.

From April 1966 to December 1967, the oceanographers recorded the following shark sightings:

Season	Number of Sharks	Hours Observed	Sharks Observed Per Hour
Winter (Jan., Feb., March)	45	30	1.5
Spring (April, May, June)	63	43.6	1.4
Summer (July, Aug., Sept.)	140	100	1.4
Fall (Oct., Nov., Dec.)	43	52.7	0.8



Each symbol on chart represents one sighting--usually a single shark but occasionally up to 10 or 15.

Although the shark watchers found it difficult to identify most of the sharks, they were able to recognize hammerheads by their unusual shape--and whale and basking sharks by their tremendous size. They estimated the majority of sharks ranged from 4 feet to 25 feet.



## New Drift Chart

A new wind drift current computation chart has been devised by Dr. Richard W. James of Naval Oceanographic Office. The Coast Guard, which has already adopted the chart, calls it "the most recent authoritative information on wind drift currents for use in search and rescue planning."

Dr. James describes wind drift currents as those caused "by the stress of the wind on the water surface." He says that knowledge of when the currents "are to be expected and with what set and drift is valuable for many marine operations," including search and rescue operations, or any marine mission involving free-floating objects. Other marine operations, necessitating knowledge of wind drift currents, involve navigation of narrow straits or confined coastal waters and ship routing.

### How Chart Works

The computation chart utilizes wind velocity in knots, fetch (the area of the sea surface) in nautical miles, and wind duration in hours. Current drift is computed in the following manner:

A 24-knot wind is forecast for a day with a fetch length of 200 nautical miles, and the wind current after 6, 12 and 18 hours is desired. Dropping vertically from 24 knots to the 6-hour duration gives a current of 0.31 knot. After 12 hours, the current has increased to 0.49 knot and by 18 hours to 0.55 knot. Use of the fetch distance instead of wind duration will also give a current in knots. Dr. James says the lower current speed is the correct one to use.

Another method is used to compensate for prior currents. The wind blows 6 hours at 12 knots and then 6 hours at 24 knots. During the first 6 hours, the 12-knot wind generates a current of 0.22 knot. A wind speed of 24 knots could create the same current in 4 hours. Adding the 4-hour duration to the 6 hours the 24-knot wind actually blows gives an effective duration of 10 hours. Using 10 hours rather than 6 hours with the 24 knots gives the correct current speed of 0.42 knot.

Because the direction of a wind drift current varies with latitude, the Coast Guard combines the chart with a deflection table. Deflection will be to the right in the Northern Hemisphere and to the left in the Southern Hemisphere. At various latitudes, deflection will be:

LATITUDE	DEFLECTION
0 degrees to 10 degrees	None
10 degrees to 20 degrees	10 degrees
20 degrees to 60 degrees	20 degrees
Greater than 60 degrees	30 degrees



## Ocean Geophysicists to Measure Movement of Magnetic Poles

U. S. Naval Oceanographic Office geophysicists are trying to determine how far the North and South Magnetic Poles have moved since the last airborne geomagnetic surveys over the Arctic and Antarctica 8 years ago.

Two flights were scheduled in September-October to investigate this natural phenomenon--movement of the magnetic poles, defined by scientists as areas, not points, where the inclination of the earth's magnetic field is 90 degrees.

On their last trip to the South Magnetic Pole, the geophysicists confirmed the existence of 2 distinct magnetic poles and the possibility of a third in the South Polar area.

### The Operation

The geophysicists will use an instrument called the Vector Airborne Magnetometer to find the 90-degree inclinations that mark the



2 polar areas. The magnetometer, which measures magnetic intensity, will guide them to the North Magnetic Pole by telling the direction of true north and magnetic north.

The South Magnetic Pole produces more magnetism than the North Magnetic Pole, which since 1831 has moved from a moderately disturbed region to a relatively quiet area. The difference in magnetic intensity at the 2 poles is due, in part, to the fact that the South Magnetic Pole is closer to the center of the source of the earth's magnetic field than the North Magnetic Pole. The center is under Southeast Asia, 80 miles from the center of the earth.

The South Magnetic Polar area also generates more local magnetism than the North Magnetic Pole because the crustal rock in the southern polar area gives rise to local magnetic abnormalities. The chemical composition of crustal sedimentary rock found near the North Magnetic Pole creates less magnetism than the volcanic rock at the South Magnetic Pole.

"Because we are interested in the main magnetic field as opposed to magnetism generated by local geological characteristics, we will be flying at altitudes of 10,000 to 15,000 feet to eliminate any distortions caused by the magnetism of local rocks," the director of the Oceanographic Office's Airborne Branch said.

#### Poles Travel in Ellipses

Observations since 1831 at the North Magnetic Pole have caused scientists to theorize that the pole travels in a series of ellipses on its circular path around the North Geographic Pole. In the 137 years scientists have been watching the magnetic pole's movement, it has yet to complete one ellipse.

Since 1841, scientists have watched the South Magnetic Pole, which also moves in a series of ellipses around the South Geographic Pole. The circular movement of the South Magnetic Pole is exactly opposite from the path taken by the North Magnetic Pole.

## Barbados Project Studies Tropical Ocean's Top Layers

Seventy scientists directed by Dr. Michael Garstang of Florida State University have completed the Barbados Project, the most ambitious study ever made of the top layers of the tropical ocean and the atmosphere above it. In this region, extending from the top layers of the ocean to the cloud layer about 2,000 feet above, much of the sun's heat, soaked up by the tropical ocean, is released into the atmosphere, powering weather systems and hurricanes moving to other latitudes.

#### Project Barbados Based

Barbados was chosen as a base because it is the most easterly island in the West Indies. It extends into the Atlantic across the constantly blowing trade winds, which mix latent heat, in the form of water vapor, with the air above the sea.

#### Methods

Using aircraft, instrument towers, tethered and free-floating balloons, ships and buoys, the meteorologists recorded temperatures, moisture, wind speed and direction, ocean currents, and cloud cover on magnetic tapes. Measurements were made along a 90-mile line, from a ship anchored 60 miles east of Barbados to a buoy anchored 15 miles west.

The data, gathered in only 3 months, will take 5 years to analyze. An even more ambitious study of the area has been scheduled for next summer; in 1970, a sea-air study will be made over portions of Florida and the Gulf.



## ESSA Laboratory in Miami

The Coast and Geodetic Survey has opened the Engineering Development Laboratory, a testing facility for oceanographic systems development, in Miami, Florida. The lab, a branch of the Office of Systems Development, will support the Atlantic Oceanographic Laboratories in Miami. Both are part of the Environmental Science Services Administration (ESSA).



The lab uses satellite navigation methods to develop projects related to high-speed charting methods and buoy tracking of ocean currents. It is stationing deep-sea buoy arrays for ocean current, tide, and wave measurements, and for magnetic observations.



## Underwater Camera Takes Circular Pictures

Naval Oceanographic Office divers are using a modified underwater camera to take panoramic pictures. The camera films the area a diver would see if he were rotated 350 degrees around his central location. His body prevents the camera from taking a complete 360-degree exposure.

Divers used the camera recently in North Carolina waters to test it as a surveying instrument. Panoramic pictures may help chart the ocean floor by establishing the center of a circle, and by enabling oceanographers to measure dimensions of the terrain within the circle. With distance as the known factor, a diver-surveyor can pinpoint the exact location of any submerged object in the camera's view.

### The Camera

The camera, NAVSCAN LOtype KE34A, is little more than a foot wide from handle to handle. It can withstand the pressure at 100-foot depths. Packed with 100 feet of 35mm ASA 400 TRI-X film, it can take 75 circular exposures. Each 350-degree negative is 0.85 of an inch wide to 14.7 inches long. The camera has an f-8 to 22 lens and a 1/150 second shutter speed.



## New Diving Techniques Used in Cobb Seamount Operation

During the week of October 6-13, a Project Sea Use team carried out diving operations on Cobb Seamount, a submerged mountain 270 miles off the Washington State coast.

Diving from the research vessel "Oceanographer," the team received special mixtures of oxygen-enriched air through life lines beneath the ship. At these depths, regular compressed air would have produced "nitrogen narcosis," a loss of physical and mental capability requiring extended decompression stops for surfacing divers. Increased oxygen reduces nitrogen absorption, lengthens bottom time, and eliminates decompression stops. BCF's decompression chamber was on board, outfitted to receive the divers for recompression, and to reduce air pressure slowly enough to prevent decompression sickness or "bends."



## C&GS Research Vessel Christened

The new Coast and Geodetic Survey (C&GS) vessel "Researcher," christened early in October in Toledo, Ohio, is the first of a new class of compact survey ships.

The 2,800-ton, 278-ft. ship, capable of handling helicopters, is equipped with the most highly sophisticated electronic and scientific instruments. She has an underwater bow bulb to house deep-finding transducer arrays, a 20-ton oceanographic crane designed to launch and retrieve small research submersibles, the latest navigational and weather devices, and can use satellite systems. Completely air-conditioned, she has 4,000 feet of enclosed laboratory space and accommodations for 18 scientists.

After completion, in 1969, she will conduct oceanographic surveys in the Atlantic Ocean and the Gulf of Mexico.



## Foreign Fishing Off U. S. in August

### NORTHWEST ATLANTIC

About 213 Soviet, Polish, East and West German fishing vessels were sighted, 32 fewer than in July.

Catches observed on all vessels were only fair. Sterntrawlers land and store catch below decks quickly, reducing the chances of observing fish on deck. However, many side trawlers, which carry catch on deck until it is discharged to support vessels, have shown only limited catches. Apparently catch per unit of effort was less than in previous years. Catch was principally herring, with some small haddock, whiting, and mixed groundfish.

**Soviet:** An estimated 118 vessels--7 factory stern trawlers, 100 medium side trawlers, 2 factory base ships, 7 refrigerated fish transports, 1 tug, and 1 tanker--fished intensively along the 40- and 50-fathom curve around Georges Bank. In early August, large concentrations spread along the eastern slopes, but by mid-month the fleet shifted west and was northeast of Cultivator Shoals to east of Nantucket Lightship.

**Polish:** Thirty-five vessels were sighted fishing along the eastern and northern slopes of Georges Bank. This is about double the number reported in August 1967.

**German:** Twenty-nine West German and 31 East German vessels fished along the northern slopes of Georges Bank during the first 3 weeks. Late in the month, they moved to areas just off Cape Cod and Cultivator Shoals.

**Romanian:** The stern trawler "Galati" was sighted in mid-month for the first time this year. She had been sighted in August 1967.

During the third week in August, from 50 to 75 Soviet, Polish, East and West German vessels suddenly moved inshore to fishing grounds 12 to 20 miles southeast of Chatham, Mass., off Cape Cod. After August 23 they moved 25 to 40 miles out from the nearest point of land.

### IN GULF OF MEXICO AND OFF SOUTH ATLANTIC

No foreign fishing vessels were sighted south of Cape Hatteras or off Florida. There were unconfirmed reports of a Cuban vessel long-line fishing 55-60 miles south of Grand Isle, La.

### OFF CALIFORNIA

One Soviet vessel, the fishery research medium trawler "Ogon," was sighted about 17 miles west of Point Reyes.

### OFF PACIFIC NORTHWEST

Forty-eight Soviet vessels, including 4 research or exploratory vessels, were sighted. The greatest effort was made in the hake fishery off Washington. Catches observed being hauled on deck varied from water hauls to 40,000 lbs. Some stern trawlers caught 50-80 metric tons a day.

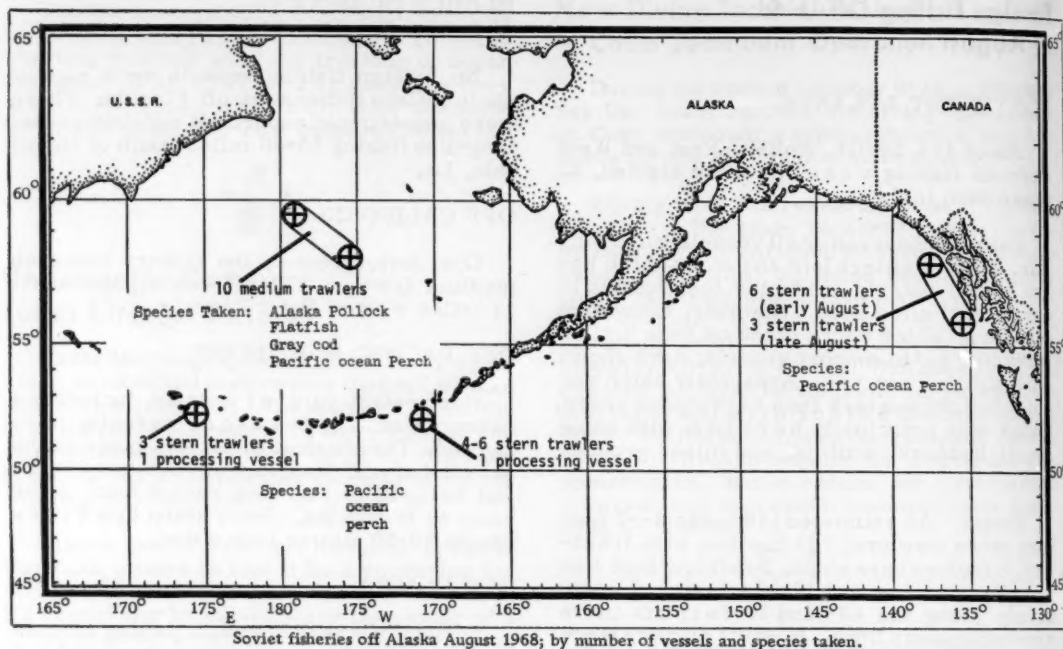
### OFF ALASKA

**Soviet:** Between 21 and 25 fishing vessels were sighted. One processing vessel and 4-6 stern trawlers, south of central Aleutians, and 3 stern trawlers with 1 processing vessel around the Near Islands, fished for Pacific ocean perch. Ten medium trawlers fished for Alaska pollock, flatfish, Pacific ocean perch and gray cod along the Continental Shelf edge in the Bering Sea. A medium research trawler engaged in king crab research in the eastern Bering Sea. A U. S. scientist boarded the vessel for about a week in mid-August.

**Japanese:** The number of vessels varied between 170 and 180.

Four to 6 stern trawlers fished Pacific ocean perch in the Gulf of Alaska. Six to 18 stern trawlers fished for perch along the Aleutians. The perch fishery in the Bering Sea, along the Continental Shelf edge northwest of the Pribilofs, continued by at least 20 independent stern trawlers in early August decreased by month's end.

In the minced fish meat and fish meal fishery, 3 factoryships and 63 trawlers centered on the Continental Shelf northwest of the Pribilofs, and 2 factoryships with 37 trawlers fished on the Shelf east of Pribilofs.



Two king crab factoryship fleets continued fishing on the Continental Shelf, north of Port Moller, in the eastern Bering Sea. One tanner crab expedition was located about 120 miles northwest of the Pribilofs fishing conical-shaped pots set on a long line.

Two small stern trawlers began fishing on known shrimp grounds near Two-Headed Island off southwest Kodiak Island. One was observed hauling aboard a trawl containing about 2 tons of shrimp. Two Japanese vessels fished for shrimp in the same area in summer 1967.



#### WHAT IS THE "BENDS" AND HOW DO DIVERS BECOME AFFLICTED WITH IT?

High pressure at depth causes some of the nitrogen in a diver's body tissue to dissolve in his blood. If he ascends too rapidly, bubbles will form in the blood and collect in his joints and bone marrow, causing the extremely painful condition known as the "bends." It is not ordinarily fatal unless bubbles collect in the spinal cord or brain, but the pain will continue for several days unless the diver is put under pressure and decompressed gradually; if the condition goes untreated there will be bone damage.

After a long dive, a diver is returned to normal pressure gradually so that nitrogen in the blood may be released through the lungs, avoiding the "bends." ("Questions About The Oceans," U. S. Naval Oceanographic Office.)



## STATES

### Alaska

#### 1968 SALMON PACK DOUBLES 1967's

By Sept. 1, the 1968 Alaska canned salmon pack was 3.1 million cases--more than double the 1967 pack of 1.4 million cases for the same period, reports BCF Juneau.

Compared with the high 1966 pack of 4 million cases and 1965's 3.3 million, the 1968 pack is considered good. During the past 13 years, the pack has neared or exceeded the 3 million figure 6 times; it averaged about 2.8 million cases. The 3.1 million cases on Sept. 1 is well above the 13-year average. When the final pack figures have been tabulated, the 1968 pack may well be one of the best for this period.

#### Record Pinks Caught

The 19.6 million pinks caught in southeastern Alaska are more than the number caught in the 1966 season when a record 1,013,825 cases were packed. The small size of the pinks, 2.8 to 3.5 pounds, compared to a normal 4.2 to 4.4 pounds, limited the 1968 case pack as of August to 932,281 cases.

Except perhaps for Bristol Bay, BCF Juneau points out, this has been a good year everywhere in Alaska. It should bring the State back to first place among the States in value of landings and fish products produced.

Along with the increase in salmon canning is a record production of salmon caviar. BCF Juneau expects that the value of this byproduct will amount to \$16 million--and will rival or perhaps exceed the value of the total U. S.-Canadian halibut catch for 1968. Caviar production has special value because nearly all of it will be exported.



### Massachusetts

#### NEW BOSTON FISH PIER COMPLEX PROPOSED BY PORT AUTHORITY

The Massachusetts Port Authority proposed on September 12 that a \$14.6 million Boston Pier complex be built to revitalize the city's declining fish industry. An engineering firm has prepared a feasibility study.

The Port Authority and the engineering consultants said primary causes of the decline were fragmented and old-fashioned operations and lack of understanding of the fresh fish market's potential.

#### Boston Near Rich Source

Edward J. King, executive director, Massachusetts Port Authority, noted that one of the richest sources of high-quality fresh fish--haddock--exists within 300 miles east of Boston. A potential \$100-million fresh-fish market in interior United States is within a day or two's drive to the west of Boston.

#### Study's Findings

The Fish Pier complex study, sponsored by Port Authority and the Boston Fish Market Corp., stressed the need for more efficient handling of fish from boat to display and auction areas; reduction of damage to fish during processing and handling; tighter controls on auctioneering practices; automated processing operations; consolidation of warehousing and storage facilities; elimination of truck and other traffic congestion; and more extensive use of transportation systems including air and rail; and consolidation of all fish-industry functions and operations in the fish-pier area.

#### Approval Needed

If the fishing industry goes along with the Authority's proposal, it will be presented to the Authority's membership for consideration.

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## Biologists Breed Lobsters Selectively

By John T. Hughes\*

After 5 years of research and selective breeding, biologists at the Massachusetts Lobster Hatchery and Research Station, Vineyard Haven, have successfully produced albino and all red colored lobsters.

The North American lobster (Homarus americanus) normally has a dark green shell with small spots of brown, white, yellow, and red. At times rare albino lobsters are caught and also lobsters that are red, blue, or yellow. The biologists at the station believed that the odd colored lobsters could be mated with one another and some of the offspring would carry genetically the odd-color characteristics of the parents.

### Early Results

Five years ago lobster men throughout New England were asked to save all odd-colored lobsters for delivery to the research station. In spring 1965, an all-red male lobster was mated with 2 all-red females. Eggs were extruded the following summer and they hatched in 1967. (From time of copulation until the eggs hatch is about 18 months.) Approximately 50% of the newly hatched fry were all red as the parents, 25% were albino, and 25% were "normal". In spring 1966, the same red male was used to fertilize an all-

red female and a lemon-spotted female. The eggs hatched in early summer 1968. Again some of the fry produced were all red, some were albino, some yellow spotted, and some normal. These lobsters are now beyond their tenth molt and almost 2 inches in total length.

### Valuable Research Tool

The biologists feel that stock from these lobsters will be very valuable as a research tool. As yet, no suitable lobster tag has been developed that will remain with a lobster after molting. Therefore, it has not been possible to follow the migrations or movements of large numbers of lobsters over a period of years. Today's tags are so large that it is necessary for a lobster to be 2 years old before it can even carry the tag. It is felt that these rare colored lobsters can be used as natural tags and studies of their movements can be started as soon as they hatch.

This initial work using selective breeding and choosing desired characteristics suggests to the Massachusetts biologists that it will be possible to choose well-proportioned, fast-growing parents to produce market-size lobsters in half the 6 years it takes in the wild.

\*Director, State Lobster Hatchery and Research Station, Vineyard Haven, Mass. 02568.



## Florida

### ACOUSTIC SIGNALS ATTRACT FISH

"A significant breakthrough in attracting certain species of commercial fish to artificially generated acoustic signals" was announced recently by the University of Miami's Institute of Marine Sciences. The Institute stated: "It is quite possible that, in the near future, commercial fisheries can use the Institute's techniques of attracting fish, coupled with the use of bait as reinforcement, to increase their catches of certain species. This is particularly true of existing snapper and grouper fisheries in the Gulf of Mexico and Caribbean Sea areas."

#### Tests in Gulf Stream

Institute Professor Joseph D. Richard carried out extensive field tests. These showed clear attraction of considerable numbers of demersal predatory fish to an area, in the Gulf Stream, where a submerged sound source transmitted pulsed, low-frequency acoustic signals. The source, an acoustic projector, is mounted on the ocean floor in 20 meters of waters, about 1 mile off Bimini. Prof. Richard observed the fish through an underwater television system. Many of his field tests have been permanently recorded on video tape.

#### The Species Attracted

Nassau groupers, mutton snappers, margates, yellowtail snappers, yellowfin groupers, and black groupers were attracted to the acoustic stimuli. So were several unidentified species of groupers and snappers. Sharpnose sharks, reef sharks, and nurse sharks also responded.

On the other hand, herbivorous reef fishes common to the test area were not attracted.

The signals transmitted in the field tests closely simulated the natural hydrodynamic sounds previously recorded by the Institute when predatory fish were feeding. In addition to the fish inhabiting the test region, these sounds should be attractive to other species with similar feeding habits, the Institute believes.

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## BUILDS 'WINDOW ON THE SEA'

A new "window on the sea"--a marine laboratory to send oceanographic research vessels out to study the Gulf and Atlantic--will be opened soon by Florida State University.

At Turkey Point, 40 miles south of Tallahassee, there is a new 180-foot concrete pier. It is capable of accommodating moderate-size research vessels like the 160-foot "Petrel," already in the harbor being converted for oceanographic research. The 65-foot "Tursiops," also being converted in the harbor, will make an initial cruise to the Yucatan Channel area this fall.

#### Lab Facilities

A research lab and classrooms building, shop building, superintendent's cottage and housing for 16 students will be completed shortly. The laboratory will sponsor studies in biophysics, genetics, meteorology, microbiology, and geology of the local environment and Gulf. Students will spend one day to several weeks in on-the-spot classroom and lab work.

One outstanding feature of the new laboratory is a sea water retrieval, storage, and delivery system. The water is stored in plastic tanks and touches no metal, which is toxic to living sea organisms.



## Virginia

### HOW TO GROW OYSTERS IN MSX AREAS

Oysters can be grown profitably in areas infested with MSX, reports Dr. Jay D. Andrews, head of the Department of Malacology at the Virginia Institute of Marine Science.

MSX is a microscopic parasite that kills many oysters but is not harmful to humans. It is a protozoan, or one-celled animal, which thrives in areas of high-salinity water. Death of oysters occurs mostly in the warm season; the winter loss is minor. MSX is now in its tenth year in Virginia with no reduction of its activity.

## MSX IMMUNITY

Laboratory-bred stocks held in trays, and natural sets in MSX areas, have demonstrated that oysters can acquire immunity to the disease if exposed when young. Dr. Andrews says that survival has been consistently favorable even through drought years, which raise the salinity that makes MSX more virulent. Losses have been about 20% per year or less, not including losses from predation and smothering.

### Culture Program

The following program for commercial culture in MSX areas is recommended:

- (1) Seed oysters must come from areas where MSX is active during spawning and setting period. Immunity is acquired early and remains fairly constant as oysters become larger and older. The Institute will check MSX activity in major seed areas using oysters from low-salinity, disease-free, areas.
- (2) Oysters must grow rapidly and be harvested early if they are to be raised successfully. This will involve critical decisions on time and size of seed oysters transplanted. They must be planted on firm bottoms suitable for small seed--relatively free from drill predation. Rapid growth is obtained by early transplanting (current year spat if bottom is hard) but this increases danger of predation.

### Where to Buy Seed

The program is feasible if Piantatank seed oysters are available. Seed from the lower James River would be as suitable for planting in MSX-infested areas as Piantatank seed, but buy-boats buy oysters indiscriminately from tongers anywhere on the river. The risk of buying seed from up-river beds, which are not immune to MSX, is too great for planters to take.

### Other Problems

Smothering, predation, Dermocystidium, and other problems--as well as MSX infection--can destroy beds of oysters. Trial planting on one bed, or involving one boatload of seed, should precede large plants in areas where MSX has destroyed oysters.



## Michigan

### CONSERVATION COMMISSION ACTS ON SALMON

In August, the Michigan Conservation Commission increased from 3 to 6 the limit of coho and chinook salmon in a sport fisherman's possession. Fishermen still may not have more than 3 salmon in their possession while fishing or aboard boats--but they can have up to 6 salmon when ashore and not fishing.

### To Sell Surplus Salmon

The Commission approved the Michigan Department of Conservation plan to sell surplus salmon for commercial purposes. High bidder for the surplus was Blackport Packing Co. of Grand Rapids. It received a contract to buy the salmon at 15.6 cents a pound.

Most of the salmon will be taken at weirs on 3 rivers tributary to Lake Michigan. Sale money will go to Michigan's Game and Fish Protection Fund.



## Oregon

### DISEASES HIT SPRING CHINOOK

The Oregon Fish Commission reported on September 6 that spring chinook salmon in adult holding ponds on the Middle Fork Willamette were being attacked by several serious diseases. Pathologists isolated and identified *Ceratomyxa*, *Henneguya*, columnaris, furunculosis and kidney disease. Each disease alone can be serious; combined, they caused large-scale mortality.

### Death Rate Rose

Only 1 or 2 fish a day died in late June, but the death rate later increased to 100 a day. Over 2,500 salmon had died by September. More than 10,000 big chinook, almost one-third the Willamette Falls escapement, were estimated to be in the holding ponds, or waiting to get in from the river immediately below Dexter Dam.

### Ponds Chemically Treated

Commission pathologists began treating the ponds 3 times a week with a chemical that reduces the effects of columnaris and fights



the spread of external fungus. The treatment was largely a holding action because there are no specific cures for some of the diseases--and no facilities to handle the mass of fish involved.

Past efforts to develop drugs and chemicals to control disease, and to administer medication on a large scale, have been hampered by lack of funds, specialized equipment, and facilities to take care of large numbers of adult salmon. Several serious diseases have been eliminated or minimized in hatchery-reared juvenile salmon by adding medication to hatchery feed. Use of oral medications at Dexter is impractical because adult salmon generally do not eat after leaving the ocean and entering fresh water. In the future, biologists hope to develop serums that can be incorporated into hatchery feed to immunize small fish against major adult diseases.

#### Many Fish Return

Despite the high mortalities, large numbers of returning fish guarantee sufficient eggs for hatchery operations. Increasing numbers of adult spring chinook have returned to the holding ponds in recent years. In 1960, only 800 fish returned, but more than 10,000 returned in 1967 and in 1968.

The two holding ponds and the Willamette Hatchery, 30 miles upstream, compensate for fish losses caused by Dexter and Lookout Point Dams. The dams, built without fish passage facilities, block all anadromous fish from the Upper Middle Fork Willamette. Returning adults are collected in the ponds at the base of Dexter Dam and held until maturity. The eggs are taken, fertilized, and transferred to the hatchery for incubation and rearing. The small fish are trucked back and released below Dexter Dam.

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#### OPENS NEW SPAWNING AREA

The construction of a fish ladder at Valsetz Dam makes available to Siletz River salmon and steelhead 30 miles of new spawning grounds this fall. The dam on the South Fork of the Siletz, about 72 river miles from the ocean, was built in the 1920s, without fish-passage facilities. Since 1950, when an impassable falls about 7 miles downstream was laddered, it blocked upstream fish passage. The fish ladder should be completed in time to pass coho and winter steelhead this year.

In 1964 and 1965, hatchery surplus adult steelhead, and coho fingerlings and adults, were released above the dam. Later, spawning-ground surveys, and trapping of downstream migrants at the dam, confirmed a belief that the area had excellent natural production potential.

#### Valsetz Latest In Program

The Valsetz Dam fish ladder is the latest project in a program begun in 1965 to provide adequate fish passage at every dam on Oregon salmon and steelhead streams. Fish passage has been improved or established on more than 840 miles of stream so far. New fishways have been built, old ones improved, and dams removed at 40 different sites throughout the state. Total natural salmon and steelhead production from these areas should add 50,000 chinook, coho, and steelhead annually to sport and commercial catches.



#### California

#### ACTS TO PROTECT KING SALMON

In August, the California Fish and Game Commission adopted a 3-point emergency program to protect the declining fall run of king salmon in the Central Valley.

The bag limit was reduced from 3 to 1 salmon on major streams in the Central Valley from Sept. 1 through Dec. 31. The streams include the Sacramento, San Joaquin, American, Feather, Merced, Mokelumne, Napa, Stanislaus, Tuolumne, and Yuba rivers and Elder, Putah, Stony, and Thomas creeks.

The spawning closure on the Sacramento River was extended from Keswick Dam to the Red Bluff Diversion Dam from Sept. 1 through Dec. 31.

The 3-mile stretch of the Sacramento River from the Highway 99 Bridge downstream to the Cypress Street (Old Highway 44) Bridge in Redding was closed to all fishing year round.

#### Ocean Catch Down

The ocean catch of king salmon has declined steadily from about 800,000 in 1964 to 400,000 in 1967. The fall run of salmon returning to spawn in the Central Valley dropped from 300,000 to 175,000 in the same period.

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## 1968/69 ANCHOVY REDUCTION FISHERY QUOTA SET

The California Fish and Game Commission has set a 75,000-ton quota for the 1968/69 anchovy reduction fishery, the same as the past 3 seasons. The season for the northern permit area opened August 1 will close May 15, 1969, and the area quota remains 10,000 tons.

### Southern Area

The season for the southern permit area's 5 zones will be Sept. 15-May 15. Each of 4 inshore zones will have a 5,000-ton quota; the offshore zone has 45,000 tons.

If the quota for either permit area is reached, the Commission will consider increasing the quota for that area. Last season, there was no fishing in one zone and light effort in several others. Landings of anchovy for reduction were 6,505 tons for the 1967/68 season.

The anchovy population in California waters is estimated at a minimum of 2 million tons.



### Texas

#### TOXIC ALGAE KILLS HATCHERY CATFISH

The killer of fish in ponds of the Parks and Wildlife Department's hatchery at Sheldon, northeast of Houston, has been discovered and controlled after 2 destructive years. It was one of the toxic blue-green algae of the genus *Anabaena*.

A school of fry (baby fish less than 2 inches long) would be alive and healthy--and the next minute, hundreds would be dead. In summer 1967, only a few fish were killed, but in 1968 the loss ran into thousands. The hatchery production of catfish seemed seriously affected.

#### Cause Discovered

Two hatchery men watching a large school of baby catfish fry gulping their way through the water saw them feed on microscopic bits of food on the surface. The fry's route took them into blue-green scum. Immediately,

hundreds of the little fish showed signs of distress and died. The green scum, an algae, was the killer.

Hot weather had caused the algae to "bloom," rise to the surface, and form scum. Ironically, the care hatchery fish receive added to their mortality. Small catfish in hatcheries are accustomed to feeding on the surface. Their diet is supplemented with finely ground food scattered on the water. The fish had mistaken the toxic algae (few algae are toxic) for food.

Once identified, chemical control of the plant is simple. Catfish farmers should look for the phenomenon in their hatcheries, advises the Texas Parks and Wildlife Department.



There are 1,356.5 acres of water in Texas being used for catfish cultivation. These should produce an estimated 3,694 tons of fish in 1968.



## Commonwealth of Puerto Rico Receives Former BCF Lab

In 1941, the University of Puerto Rico gave BCF 2 acres of land on which to build a \$25,000 fishery research laboratory. Since 1948, when BCF personnel were withdrawn, the lab has served the university's marine-biology program. The lab was declared surplus government property and recently was donated to the university.

The BCF lab had sought better methods of using available species and taught refrigeration and marketing techniques. Some exploration for pelagic species, such as tuna and mackerel, was done.

#### Puerto Rican Industry

Puerto Ricans eat much more fish than is available from the immediate vicinity. Abundance of fish is limited because the island, peak of a high ocean mountain, lacks the "shelf" formation that provides fishing grounds for most coastal areas.

There are 4 tuna canneries on the island. Most of the tuna is caught in the tropical Pacific, transported through the Panama Canal, and landed at Puerto Rico for processing.



## BUREAU OF COMMERCIAL FISHERIES PROGRAMS

### Thread Herring Reared in Miami Lab

For the first time, the "thread" herring (*Opisthonema oglinum*) has been reared from egg through juvenile stages in a marine laboratory. This was achieved in BCF's Miami Tropical Atlantic Biological Laboratory (TABL).

According to Laboratory Director Dr. Carl J. Sindermann, research scientists there strove for many months to devise means of nurturing pelagic (open-sea) fish native to tropical Atlantic waters, under artificial circumstances, from egg to healthy adult. Their work with the thread herring proved a shining success.

The silvery, compressed fish is plentiful in the waters around the southeast U. S. It is considered a good source of fish meal and a potential source of fish protein concentrate (FPC). It is called thread herring because of a long, slender filament that extends back from the dorsal fin almost to the tail.

#### The Operation

Dr. Sindermann said it was the first time marine biologists had been able to identify the thread herring in its larval stage (between egg and almost fully formed juvenile).

The 300 eggs measuring about 1 millimeter each that began the project were caught in the Gulf Stream by plankton sampler manned by laboratory scientists Dr. William J. Richards and Barbara Palko. The eggs were transferred to a TABL aquarium containing water from the site of capture. Two days later, they hatched into the larval stage: tiny creatures about 4 millimeters long. The third day after capture, the larval fish began to feed on plankton gathered from nearby Biscayne Bay. Water temperature was maintained at 80° F. throughout the experiment.

Within 30 days, the larvae had developed into juvenile fish 1 to 2 inches long--big enough for biologists to be sure of the species. Survival rates are considered excellent at 30 to 40 percent of the original 300 eggs, or well over 100 healthy thread herring. The survivors are expected to reach their normal size of 8 to 10 inches.

The TABL scientists say that although a number of freshwater species of fish have been cultured from egg to maturity, each successful rearing of a marine fish represents a rare and significant achievement.



### Genetic Variants Point to Isolated Populations of Pacific Hake

"Studies on genetic variants in Pacific hake (*Merluccius productus*) strongly support the hypothesis that there are at least two distinct and isolated populations--one in Puget Sound and another off the coasts of Washington, Oregon, and California." This was reported by Rae R. Mitsuoka, writer-editor, BCF Biological Laboratory, Seattle, Wash.



Pacific Hake (gauge = 15 cm.).

He disclosed: "Puget Sound hake are generally smaller (average, 35 cm.) than those in coastal waters (average, 50 cm.). The otoliths, or ear bones, of the two populations also vary. It is more difficult to assign ages to hake from Puget Sound because the annular zones are more irregular (although this difference may not necessarily be a function of the smaller size). Hake of oceanic size have occasionally been caught in Puget Sound, which raised the question of whether the larger fish were migratory or indigenous.

"Two enzyme systems, which directly reflect basic genetic differences of hake, were studied. These systems included esterase variants in the eye fluids and lactate dehydrogenase (LDH) variants in extracts of liver tissue.

"The gene frequencies of the large and normal fish in Puget Sound agreed with those of smaller fish from the same area. This

indicated that the larger fish are indigenous to Puget Sound. It is interesting that all the large hake caught in Puget Sound were females, which are larger at maturity than males."

The genetic studies were conducted by his colleague, Fred M. Utter.



## 55,000 Fur Seals Harvested on Pribilofs

The harvest of fur seals on the Pribilof Islands through August 13 was about 55,000: 45,000 males and 10,000 females. The harvest of males ended August 13; that of females continued through August 19 until the quota of 13,000 was reached.

Below 1967 & Prediction

The male harvest was 10,000 below 1967's and 5,000 below prediction.



## Harvesting Catfish in Hot Weather

Continued progress on safe harvesting of live catfish from farm ponds during hot summer months resulted from experiments at the BCF Exploratory Fishing Station, Kelso, Ark.

A floating 300-gallon-per-minute pump was used to circulate water through catches in a fish bag during seining operations. Four catches, ranging from 3,000 to 10,000 pounds each, were successfully handled even when water temperatures exceeded 90° Fahrenheit.



## BCF's Fast-Sinking Tuna Purse Seine Catches Elusive School

BCF's experimental fast-sinking purse seine, fished by the "Liberty" in the Pacific, took 30 tons of bonito in one set. This followed unsuccessful attempts by 2 other vessels using conventional seines to catch the school.



## 'Hero' Conducts Fishing Gear Trials

The new National Science Foundation (NSF) vessel Hero left the Washington, D. C., Navy Yard on Sept. 10 to carry out fishing-gear trials while en route to Miami, Fla.

The Hero is a 125-foot, diesel-powered but sail-equipped, wooden ship built for research in Antarctic waters. BCF's Seattle (Wash.) Exploratory Fishing and Gear Research Base recently received an NSF grant to conduct surveys of midwater and demersal (bottom dwelling) species from the Hero in the Antarctic. The Seattle staff will begin to participate in the Antarctic program in April-May 1969.

Seattle Aids Hero

Before the Hero left Washington, Miles Alton and Ian Ellis of the Seattle Base installed midwater trawl gear and depth-telemetry equipment. They accompanied the vessel to Miami to handle any problems.



## Vacuum-Stern Thawing of Frozen Fish Is Tested

Scientists of the BCF Gloucester (Mass.) Technological Laboratory recently tested the vacuum-steam thawing process for rapidly thawing blocks of frozen fish. They were permitted to use the test facilities of the Croll-Reynolds Company in New Jersey.

In one test, the internal temperature of a frozen and glazed block of shrimp was raised from the low 20s F. to about 65°-70° F. by exposing the shrimp to a 10-second burst of steam under vacuum. Almost all ice was removed; the individual shrimp were separated very easily.

Process Has Good Potential

The researchers believe these results show the good potential of the process for the shrimp industry--and suggest that the possible usefulness of the process to the tuna industry be investigated.

Vacuum-steam thawing has these advantages: thawing is achieved very quickly because it takes place in a vacuum; oxidation



problems are almost eliminated; weight losses are minimal because thawing occurs in a moist atmosphere; bacteriologic problems of water thawing are eliminated; heat damage to the product is minimal.



## Controlled Atmosphere Shipment of Fresh Fish Studied

BCF Technological Laboratories at Ann Arbor, Mich., and Seattle, Wash., have conducted research on the use of controlled atmosphere to extend the shelf life of fresh fish. Preliminary tests showed that fresh salmon can be kept under refrigeration for 20 days in a controlled-atmosphere container without spoiling.

To evaluate the benefits of this new preservation method, BCF staff is working with Transfresh Corp. on a trial shipment of fresh silver salmon by truck to a Washington, D. C., retail chain.

Truck shipments using controlled-atmosphere containers and refrigeration may offer an alternative to the more expensive air shipments.



## Fresh Coastal Fishery Products Flown to Midwest

BCF's marketing staff helped to increase the amount of fresh coastal species airshipped into U. S. Midwest markets this summer. Food chains in Minneapolis, Minn., and Cleveland, Ohio, were the latest to introduce fresh fishery products.

One chain sold over 40,000 pounds of silver salmon in a short period. Another sold 6,000 pounds of fresh halibut and salmon this summer; last year it successfully introduced fresh rainbow trout.

Planes flying to the Midwest from the coasts are developing delivery "routes" for fishery products--and servicing retailers in Milwaukee, Wisc., and Minneapolis on the same flight.



## Plankton Workshop Held at La Jolla

Scientists from BCF labs, the Bureau of Sport Fisheries & Wildlife, and the Scripps Institution of Oceanography took part in a BCF-sponsored Plankton Workshop at the Bureau's Fishery-Oceanography Center at LaJolla, Calif., in late July.

They discussed problems of accuracy, such as extrusion of plankton through the mesh of a net, avoidance of nets, effect of patchy plankton distribution on sampling precision, and experiences in such large cooperative surveys as EASTROPAC (Eastern Tropical Pacific program).

### Plankton Survey Effectiveness

They showed much interest in the effectiveness of plankton surveys in evaluating distribution and spawning intensity of commercially valuable fish stocks.

Plankton voluming and sorting, data analysis, larval fish identification, net towing, and new approaches to plankton sorting and collection were demonstrated.



## Miami Lab Releases More Drift Bottles

Thirty-six hundred empty beer bottles, inanimate researchers in a study of surface current patterns in the tropical Atlantic and Caribbean, were released by BCF's R/V "Undaunted" as she steamed to Africa last August. The bottles were donated to the BCF Tropical Atlantic Biological Laboratory (TABL) by the Miller Brewing Co. of Milwaukee.

During 1967, almost 5,000 drift bottles from a previous donation were released in and around the Florida Straits, Caribbean, and in the eastern tropical Atlantic off Africa. Five hundred and eighty-two were recovered--an overall return of 13%. Some areas yielded a 58% return.

Each bottle contains sand for ballast and a fluorescent, bright-orange card printed with a message in Spanish, French, Portuguese, and English. The message asks finder to fill in details about his discovery on an attached postcard addressed to TABL. TABL thanks

the finder, sends him a small chart showing track the bottle might have followed, and a cookbook of fish recipes in Spanish and English.

#### Finders Send Personal Messages

Many finders send personal messages. An ex-school teacher from Guyana was irate when he did not receive "a special reward like even a small outboard engine;" a fisherman from St. Jean du Sud Island requested "things necessary to subsidize my needs for fishing," and added: "I expect you will make me a researcher;" a Bahamian wrote that he had borrowed postage money and asked for "a pocket full" in return; still another expected a transistor radio.

A poignant communication in Spanish came from San Blas: "I saw a bottle which contained a card and also dry sand. The sand had some particles which sparkled and the sparkles of sand and the card inside frightened me. I bent over and seized the bottle; I wanted to show it . . . . We began to open the bottle and take out the card, but we did not want to touch the sand because we were afraid of the glistening particles. The card is wrinkled because we could not take it out. Please excuse us for that."



#### Lobster Tagging Study Off New England

Scientists of BCF's Biological Laboratory at Boothbay Harbor, Maine, have tagged over 2,000 lobsters off the southern New England coast. Their purpose is to learn about migration, growth, and survival of deep-sea lobsters--and their relationship, if any, with native coastal stocks.

#### 30 Recaptured

Commercial fishermen have caught 30 tagged lobsters. Several lobsters had made long shoreward migrations: one covered 97 miles of ocean bottom in 27 days; another--an egg-bearing female--traveled 77 miles in 28 days.



#### 'National Geographic' Features Research of Auke Bay Lab

The research of BCF's Biological Laboratory at Auke Bay, Alaska, was a major theme in the article on salmon appearing in the August issue of the National Geographic magazine.

Photos included pink salmon spawning at Little Port Walter, Alaska, micro-wire tagging and fluorescent pigment marking of fry at Traitors Cove, Alaska, and tracing migration of pink and chum salmon at Olsen Bay, Alaska.



#### Attraction of Herring to Artificial Lights Studied

Biologists at BCF's Boothbay Harbor (Maine) Biological Laboratory have completed studies on the attraction of herring to artificial lights. Repeated experiments have confirmed that attraction increases at lower temperatures, lights are more effective below the surface than above, and optimum light intensity is greater below.

#### Prior Adaptation

The effect of prior adaptation on response is still uncertain. Although previous experiments indicated that prior adaptation to darkness produced a weaker response than prior adaptation to light, differences were not significant, and the experiments are being repeated.

#### Feeding Habits of Herring

Other studies at the lab have shown that herring feed on herring. Larval herring remains were found in the alimentary tracts of 46% of the adult herring samples collected this summer. Continued sampling will enable researchers to estimate the frequency at which the adults prey on their young.



## 'Delaware's' Gloucester Trawl Catches Exceed Commercial Catches

The primary objective of the BCF Delaware's August cruise was to measure openings and other factors in 3 models of the Gloucester trawl under actual fishing conditions in 35 to 100 fathoms. (Cruise 68-7, Aug. 13-22.) A secondary objective was to take similar data on a #36 trawl for BCF's Biological Laboratory at Woods Hole, Mass.

Twenty tows of various duration were made in the Bay of Fundy area, mostly where New England based trawlers were fishing. The researchers used 3 sizes of the BCF Gloucester trawl developed at the Exploratory Fishing and Gear Research Base, Gloucester, Mass. One tow was made off Cape Ann, Mass., with a manila #36 trawl. The Delaware's catches were equal or superior to the catches of the commercial vessels.

### Gloucester Trawls

The 3 sizes of Gloucester trawls fished and measured were: (1) an 88-foot headrope, 100-foot footrope trawl with  $4\frac{1}{2}$ -inch mesh throughout the net, (2) an 86-foot headrope, 106-foot footrope trawl with 6-inch mesh in wings and square and  $4\frac{1}{2}$ -inch mesh in remainder of the trawl, and (3) a 106-foot headrope, 128-foot footrope trawl with 6-inch mesh in wings and square and  $4\frac{1}{2}$ -inch mesh in remainder of the trawl. Trawl number 3 was made up and measured in anticipation of its use aboard the new stern trawler research vessel "Delaware II." All these trawls used the same set of rubber roller gear. This gear was made up of discs and 18-inch wing rollers in the wings and 22-inch rollers in the bosom (see illustration).

### Results

Trawl net factors in the 4 trawls used were:

Trawl Net Measurements Under Tow				
Net	Footrope	Wing End	Headrope Height	Wing Spread
A	100'	12'	17'	50'
B	106'	13'	16'	48'
C	128'	-	27'	40'
D	#36 trawl	6'	6'	41'

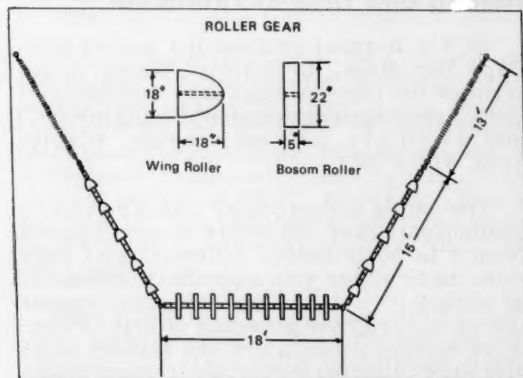
Notes: (1) Figures shown are averages from all data collected on each trawl.

(2) Data collected on Net B were influenced by numerous changes to trawl and rigging. The lack of a wing end height for net C was due to damage to wing end transducer.

The figures given are those recorded when the net had settled down and was being towed in a straight line. Over the years, trawl

instrumentation activities at the BCF Gloucester base have resulted in compilation of many readings on various trawl nets. With few exceptions, it has been found that trawls require time to settle down before reasonably steady readings occur; also, that tides, rough seas, and types of bottom towed over are factors that affect trawls.

The researchers report that use of the wing end transducer sounding downward indicates that the Gloucester trawls offer a considerable wing end height. This has 2 obvious advantages: (1) the fish-herding effect of a wing is acting at a far greater height off the bottom, and (2) the possibility of a headrope hangup is reduced considerably. This was demonstrated on a previous trip. At that time, with the vertical wing-end transducer on the wing, a Gloucester trawl was towed up a precipitous ridge from 94 to 62 fathoms depth. The wing end was 14 feet off the bottom at the start of the climb. This height diminished to 4 feet before the trawl climbed over the ridge. Had the #36 trawl with its 6-foot wing end height been towed over this ridge, it is reasonable to believe that the headrope would have touched bottom.



Roller gear used on Gloucester trawl; Delaware Cruise 68-7.

### Advantages of Trawl's Opening

The trawl achieves a higher opening. At the same time, other fishing characteristics, such as bottom contact and wing spread, remain constant--or comparable to a standard trawl. Obviously, the trawl should take better catches of groundfish species, such as cod, pollock, haddock, and others that sometimes swim up off the bottom. Fishing results of the Delaware's Cruise 68-7 bear out this advantage. To compare catch rates, tows 1

through 13 were made in an area in which commercial trawlers were operating. During these tows, catches of the Delaware always equaled or exceeded catches of commercial vessels, although the Delaware's tows were much shorter. Tows 14 through 20 were not made in company with commercial trawlers but on grounds where fish apparently were much less abundant.

There was no incident of damage to the gear under tow during the entire cruise. Reports of damage among the trawlers were heard over the radiotelephone. The results of this cruise and Cruise 68-2 suggest the roller rig used (illustrated on page 29) is more effective at reducing damage than the standard wooden rollers. More trials with this gear will be undertaken.

Note: For additional information, contact Keith A. Smith, Base Director, or Robert A. Bruce, Fishery Methods and Equipment Specialist, EF&GR Base, State Fish Pier, Gloucester, Mass., 01930, Telephone: 617-283-6554.



## 'Rorqual' Studies Post-Metamorphosed Herring and Their Environment

BCF's Rorqual cruised the waters from Cape Ann, Mass., to Eastport, Maine, to determine the relative abundance and distribution of post-metamorphosed herring (brit 3") and to sample their environment. (Cruise 7-68, 8/7-8/22.)

The ship's echo-sounder was operated continuously over the entire cruise transect from 5 to 50 fathoms. Fifteen trawl tows were made either with a Boothbay Depressor or shrimp trawl net on significant echo sounder traces to verify the presence of brit. Fifty-three surface temperature and salinity samples were collected at selected transect points and at all tow locations.

### Preliminary Findings

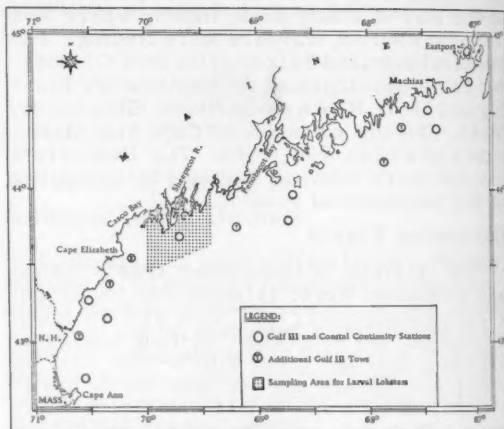
Medium-to-heavy surface traces were observed only from Penobscot Bay to Petit Manan. These traces were particularly heavy around the headlands from Dyer Bay to Mount Desert. From Penobscot Bay to Casco Bay, the traces were light and scattered. Repeated tows through the waters where the traces occurred failed to take any fish.



## 'Rorqual' Checks Distribution of Larval Lobsters Off New England

The Rorqual investigated the distribution of larval lobsters and other zooplankton in the waters from Cape Ann, Mass., to Eastport, Maine. (Cruise 6-68, 7/17-8/6.)

During Phase 1 (July 17-26), a 2x1m neuston net was towed to collect lobster larvae at the surface for 30 minutes in the area shown on the chart.



R/V Rorqual Cruise 6-68, July 17-Aug. 6, 1968.

During Phase 2 (July 29-Aug. 6), oblique tows were made simultaneously from 0 to 20m for 30 minutes. The researchers used paired bongo nets (0.03 mouth area) and a Gulf III sampler at 10 coastal continuity stations--and at 6 other stations shown on the chart. Neuston tows also were made at each sampling location.

### Preliminary Findings

During Phase 1, 65 lobster larvae were collected on 3 inshore-offshore transects sampled off Casco Bay, Boothbay Harbor, and Muscongus Bay. Most of the larvae, 57 or 88%, were in the first larval stage; 8 were in the second stage. First-stage larvae were widely distributed; second-stage larvae occurred only offshore. The catch-per-tow of larvae decreased from inshore to offshore in a distribution pattern that suggests inshore origin. The catch of larvae in the neuston tows made along the outer coastal area, from Cape Ann to Eastport, was limited to four stage one specimens.



Zooplankton standing crop in summer decreased to 2.28 cc/100m<sup>3</sup> (of water strained) from the preceding spring mean of 8.92 cc/100m<sup>3</sup>. The greatest decrease was in the western area. Volumes in the central and eastern Gulf coast were not significantly different from the spring values. In previous summers, volumes generally decreased from west to east. During the cruise, however, zooplankton volumes among the 3 areas sampled were not significantly different.

#### U. S.-USSR Cooperation

As part of the U. S.-USSR cooperative investigation of plankton sampling methods, comparisons were made between the catching efficiencies of the Gulf III sampler and paired bongo nets (0.03 mouth area) used during the cruise. In 9 of 10 simultaneous tows made with the samplers, the bongos collected more zooplankton. The smaller zooplankters apparently were extruded through the rigid meshes of the Gulf III. The smaller copepod species--*Pseudocalanus minutus*, *Acartia* sp., and *Centropages hamatus*--were 5 to 30 times more numerous in the bongos. Catches of the larger copepods, particularly *Calanus finmarchicus*, were similar in the 2 samplers.



#### 'Cobb' Tests Shrimp Trawl Separator

BCF's John N. Cobb cruised for 26 days off Oregon testing shrimp trawls equipped with experimental devices for separating shrimp, *Pandalus jordani*, from other bottom-dwelling invertebrates and from fish. (Cruise 96, ended 8/2.)

#### Gear

Basic gear was two 57-foot headrope length semiballoon shrimp trawls having 2-inch stretch mesh webbing. Some tows were made using a shrimp try net with a panel of 3-inch web separating the trawl into upper and lower sections.

#### Methods

Scuba-equipped gear specialists observed the trawls in operation and determined trawl configuration for various modifications.

In several experiments, various portions of the trawls were covered with lightweight

$\frac{3}{4}$ -inch mesh web to determine escapement of shrimp and fish through the larger trawl web. Later, large areas of the trawl were covered with  $\frac{3}{4}$ -inch web and the catch was isolated from the main trawl codend.

Comparative tows between 2 trawls were made simultaneously by joining one wing of each trawl and towing from a 3-warp system. The vessel trawl net reel was equipped with tow cable to pull the common center wing.

An Oregon Fish Commission biologist gathered data on size, age, and sex composition of shrimp retained in various experimental net configurations.

#### Results

Experiment 1: Exterior liners of  $\frac{3}{4}$ -inch mesh web, attached along each side panel of trawl from wings to intermediate, retained shrimp and fish that normally escaped through that part. Of the total catch made during 4 tows, 60% of the shrimp were retained in the liner codend after passing through the 2-inch mesh trawl. Only 4% of the fish and invertebrates passed through to exterior section. Average proportion of age 1 shrimp was 0.7% in trawl codend and 4.8% in exterior liner.

Exp. 2: An exterior liner of  $\frac{3}{4}$ -inch mesh web placed over top panel of trawl and aft to codend indicated that shrimp also passed through the top of trawl. Of total shrimp catch made during 10 tows, 29% were retained in the liner codend after passing through 2-inch top portion of trawl. *Eulachon*, *Thaleichthys pacificus*, was the dominant species in the liner catch and comprised 2% of total fish and trash catch.

Exp. 3: Four tows were made with a 2-inch mesh trawl completely enclosed, with the exception of the trawl belly, in a series of exterior  $\frac{3}{4}$ -inch mesh covers. Riblines added to trawl side seams allowed side panel meshes to open fully so shrimp could pass through and be separated from remainder of the catch. Ninety-three percent of the shrimp captured did pass through the 2-inch trawl web and were retained by the external covers.

Exp. 4: A small Gulf-of-Mexico-type try net, which incorporated a horizontal 3-inch mesh web panel to separate upper and lower parts of the trawl, successfully restricted nearly all trash species to bottom portion of trawl. Unfortunately, although most unwanted

species were separated, only about 17% of the shrimp passed through the separator panel into the top section.

Exp. 5: A dual net trawling technique was tested that permitted an experimental net to be fished simultaneously with a control net. It was necessary to use more tow cable than when towing a single trawl to hold the center wings at the ocean floor. The two 57-foot shrimp trawls covered a path about 45 feet wide; a single trawl covered only a 25-foot path. Both trawls were wound onto a single trawl net reel.

## Results

The experiments provided useful information for effective trawl design. None of trawl configurations tested was intended to operate as a commercial net. However, 2 prototype commercial trawls were constructed following cruise that used the experiment results. These trawls will be tested during Cobb Cruise No. 97.

Note: For further information contact: Dayton L. Alverson, Base Director, Exploratory Fishing and Gear Research Base, 2725 Montlake Blvd. E., Seattle, Wash. 98102. Phone: 583-7729.



## 'Commando' Evaluates Mark II Universal Trawl

The BCF chartered research vessel Commando conducted a 17-day study in the coastal waters of Washington and northern Oregon in cooperation with the Atomic Energy Commission. (Cruise 15, ended 6/30.)

Cruise objectives were to (1) evaluate the Mark II Universal trawl for sampling off-bottom fish populations; (2) determine relative distribution of midwater biomass (amount of living matter) in relation to sound-scattering layers; (3) assess feasibility of using a drone to increase efficiency of searching for midwater fish schools.

## Gear

Fish populations were sampled with a Mark II Universal trawl. This net has a 94-ft. headrope and footrope. It was rigged with 41 floats equally spaced on the headrope, and  $\frac{1}{2}$ - and  $\frac{3}{8}$ -inch chain on the footrope. The forward part of the net was 5-inch polyethylene web with intermediate and codend sections of

$3\frac{1}{2}$ -inch mesh polyethylene web. The codend was completely lined with  $1\frac{1}{8}$ -inch mesh. All tows were made using 5-ft. by 9-ft. aluminum V-doors weighing about 675 pounds each. Three-leg, 30-fathom bridles attached the doors to the net. The gear was towed with  $\frac{5}{8}$ -inch diameter electromechanical cables. Pressure-sensitive depth-telemetry equipment was used to determine depth of fishing.

A 6-foot Isaac-Kidd trawl was used to sample nekton. Body and intermediate sections of the net were  $3\frac{1}{2}$ -inch mesh webbing, lined with  $\frac{1}{8}$ -inch mesh nylon netting; codend was  $\frac{1}{8}$ -inch mesh nylon netting.

The 23-ft. auxiliary research vessel "Sea Probe" was used to determine the feasibility of scouting for fish using a small vessel. This vessel worked with Commando during fishing trials and was equipped with a radio-telephone and a 200-fathom sounder having a fish-discrimination feature.

## Method of Operation

A survey was conducted in the offshore area from Cape Flattery, Wash., to Tillamook Head, Ore., from nearshore to 30 miles off the coast. The area contiguous to the Columbia River mouth was emphasized. All fishing was conducted in less than 75 fathoms.

Fish were located by offshore-inshore sounding transects. When scattering layers were recorded by the high resolution, low-frequency echosounder, they were fished with Universal and Isaac-Kidd trawls to determine their composition. Trawl hauls also were made above and below sound-scattering layers appearing on the echograms to ascertain availability of fauna at these depths.

Towing speed for the Universal trawl ranged from 2.5 to 3 knots and for Isaac-Kidd trawl from 5 to 6 knots. Twenty-six Universal and 9 Isaac-Kidd trawl hauls were made during cruise at depths to 62 fathoms.

## Evaluation of the Mark II Universal Trawl

The trawl was rigged with 31 floats and fished in 10 fathoms at 2.1 knots. Scuba-equipped divers determined the trawl's vertical opening as 22 to 24 feet at the wingtips and 27 to 28 feet at the center of the net. Tension was about 2,000 pounds on each warp. The aluminum V-doors performed satisfactorily; because weight was concentrated in the

shoe, doors were very stable when fished both on- and off-bottom. The net tended bottom well during the tow but, because of the disproportionate weight of chain on the footrope, 10 more floats were added to lighten the trawl.

Mark II Universal trawl fished on- and off-bottom fish populations satisfactorily. Groundfish catches exceeded 4,000 pounds per 1-hour tow. Also catches from off-bottom concentrations of hake up to 12,600 pounds per 1-hour tow were made on moderate sign. A slight gilling problem in the net's after body occurred when fishing hake. In one tow, 1,000 pounds of white bait smelt, *Allosmerus elongatus*, averaging 9 cm. in length were taken. This suggested that the net effectively samples small fish populations.

#### Distribution of Midwater Biomass

Two series of Universal trawl and Isaac-Kidd trawl hauls were made at various levels to ascertain vertical distribution of midwater biomass in relation to sound-scattering layers.

The first series was made over a bottom depth of 40 fathoms off the mouth of the Columbia River at 46°11' N. latitude and 124°13' W. longitude. Three sound-scattering layers were found. The upper two were diffuse, while the layer just above bottom was more distinct and typical of "sign" usually ascribed to hake.

Nothing of consequence was caught at any depth not showing a scattering layer.

#### Drone Simulation

The auxiliary research vessel Sea Probe cooperating with Commando simulated a drone vessel for fish scouting. Sea Probe scouted for and reported location of schools to Commando, increasing search effectiveness. The former also determined areas of highest abundance in front of Commando during actual fishing. This information was useful in directing Commando during the operations. Visual reconnaissance of Sea Probe's position was not possible beyond 3 miles, and radar was ineffective due to interference from sea return.

#### Technological Studies

Technologists checked incidence of a myxosporidian parasite in hake from 10 lots

samples. Initial observation of high overall parasitization of stocks, with hake from in-shore hauls having a somewhat higher incidence, continued as in previous years.

Technologists also tested the enzymatic softening of hake at various storage temperatures--and the effect of blood upon oxidative rancidity of rockfish fillets during storage. Two hundred pounds of fillets of various species and 300 pounds of whole hake were collected for studies to determine possibility of making "surimi" (minced fish flesh) and "kamaboko" (fish paste).

#### Biological Studies

Groundfish Program personnel sampled and processed 1,500 hake at sea for length, sex, and age. Twelve hundred more hake were returned to the Seattle Lab to be processed for length, sex and age--and for physiological work on livers, hearts, and eye fluids. This research is part of a program to monitor the condition of hake stocks off the Pacific coast.

Note: For further information contact: Dayton L. Alverson, Base Director, Exploratory Fishing and Gear Research Base, 2725 Montlake Boulevard East, Seattle, Wash. 98102. Phone: 583-7729.



### 'Gilbert' Finds Threadfin Shad & Nehu About Equal Tuna Bait

BCF's Charles H. Gilbert cruised Hawaiian waters to test threadfin shad as a live bait in the pole-and-line fishery for skipjack tuna. The nehu is the bait used in this fishery. (Cruise 109, 5/16-8/3.)

Experimental pole-and-line fishing was conducted with 12 skipjack tuna schools using threadfin shad as bait--and with 10 skipjack tuna schools using nehu as bait. Pole-and-line fishing was conducted with one other skipjack tuna school using both threadfin shad and nehu.

The experimental fishing results are summarized in table.

The researchers report: "There is no significant statistical difference between the catch per unit of effort (mean number of tuna per minute) ( $p > 0.4$ ) between threadfin shad and nehu."

Experimental Fishing Results, Charles H. Gilbert, Cruise 109

Bait	No. of Schools	No. of Tuna Caught	Wt. of Tuna Caught	Size of Tuna Caught (Avg. Wt.)	Avg. No. of Tuna/Min. 1/	Avg. Lbs. Tuna/Min.	Avg. Lbs. Tuna/Lb. Bait	Avg. No. Passes/School	Avg. No. of Bait Buckets/School
Shad	12	1,286	6,726	5.2	8.1	42.1	21.5	3.1	3.7
Nehu	10	1,250	9,236	7.4	9.8	72.5	28.3	3.1	4.6
Total	22	2,536	15,962	-	-	-	-	-	-

1/ Four men fishing almost constantly.

### The 2 Baits

In general, threadfin shad swim downward at angles estimated to be  $45^{\circ}$  to  $60^{\circ}$  after being chummed into the water. Nehu tend to dive down at somewhat steeper angles, estimated at  $60^{\circ}$  to  $80^{\circ}$ . Threadfin shad do not appear to dodge as vigorously as nehu--but appear to be much more visible than nehu from the Gilbert's stern underwater chamber. All sizes of threadfin shad ( $1\frac{1}{2}$ "- $2\frac{1}{2}$ ") appear to exhibit the same swimming behavior.

The Gilbert researchers also tested various "transporting, handling, and acclimatizing techniques" to obtain better survival and use of bait. They also collected specimens for themselves and for other scientists in the U. S. and Great Britain.



### 'Cromwell' Studies Ultrasonic Tags in Sonar Tracking of Tunas

One mission of BCF Honolulu's vessel Townsend Cromwell in a recent cruise in Hawaiian waters was to determine the feasibility of using ultrasonic tags to improve the tracking of tunas with the CTFM sonar. (Cruise 37, 6/5-7/31.)

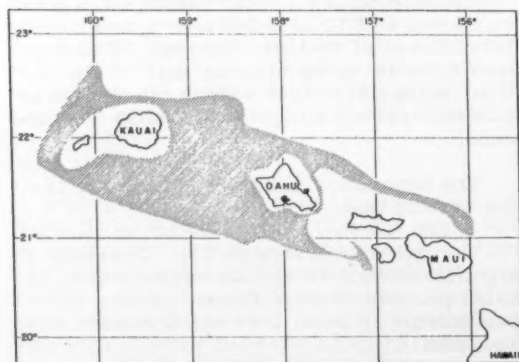
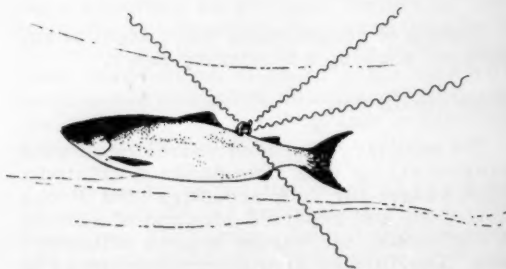


Fig. 1 - Area of sonar operations.

The scientists used cylindrical tags 3 inches long and  $1\frac{1}{8}$  inches in diameter. The tags transmitted pulses at a rate of 1 per second that were readily detectable 1 mile away. Because the vessel did not have facilities for holding skipjack tuna, 3 little tunny held in captivity for 15 months were tagged and released at sea on separate occasions.

### The Operation

Each tag was attached to the fish in the same manner. It was tied securely to the shank of a fish hook. The hook was inserted across the midline immediately posterior to the second dorsal fin. The tunny first was released in a school of skipjack, the second with no fish in sight, and the third in a school of yellowfin. Tracking durations were 77, 117, and 21 min., respectively. On the last two occasions, tracking ended when the tags sank out of range. Neither of the 2 fish released in schools appeared to have joined the schools. All 3 swam off at about 2 knots.



### Tag Burdens Small Fish

Later, one of 4 little tunny in a pool at the Honolulu Laboratory's Kewalo Basin was tagged and observed. It was soon obvious that the tag was a burden to the 4-pound fish, which was the size of the others tagged. The tag carrier beat its tail continuously, in contrast to the untagged fish. It always swam closer to the bottom than the other, and it did not school with them except for short, intermittent periods. After 117 min., the tag slipped off the fish.



## Sharks Tagged

Two gray reef sharks (*Carcharhinus menisorrh*) were caught off Niihau, taken out to sea, tagged, and released. Only brief contact was made with the first shark. Failure to track this shark resulted from a combination of 2 factors: the tag did not start transmitting immediately, and the sea was very choppy.

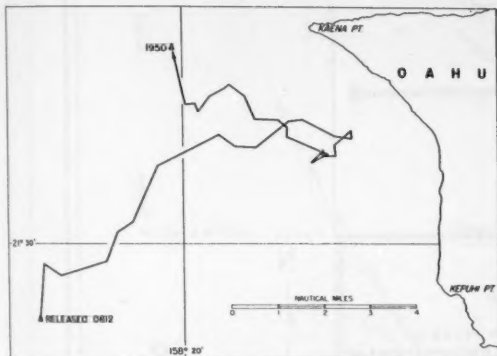


Fig. 2 - Path of tagged shark.

The other shark had a tag introduced into its gut before it was released off leeward Oahu. The shark moved about 17½ miles in the first 12 hours (fig. 2). Then, at sundown, it moved toward the bottom, which was 500 m. deep. When it remained stationary throughout the night and past sunrise, the researchers assumed the shark had ejected the tag. Tracking was discontinued.

## Following Tagged Fish Practical

The researchers concluded from the ultrasonic tagging experiences that: (1) following a tagged fish with a ship is practical; (2) tag dimensions must be reduced if fish the size of skipjack tuna are to be tagged; (3) a tag placed inside the fish works as well as one placed externally.



## 'Oregon' Conducts Midwater Schoolfish Survey Off East Coast

BCF's Oregon completed the fourth in a series of 6 bimonthly midwater schoolfish survey cruises. (Cruise 131, 7/16-26.)

The series is designed to obtain information on seasonal distribution and schooling

density of pelagic schoolfish in coastal waters (5-20 fms.) between Cape Hatteras, N. C., and Jupiter Inlet, Florida. The information will be used to establish criteria for exploratory and experimental fishery operations along the southeast coast. (See chart p. 36.)

High-resolution vertical echo tracings were obtained on 26 standard transects. Continuous surface temperature data and vertical temperature profiles were obtained on all transects.

## Findings of Fourth Cruise

Preliminary examination of echo tracings indicated that midwater fish were more prevalent in school size and number than on previous cruises. Heaviest fish concentrations off Florida were located east of Mayport and St. Augustine and off Cape Kennedy. Off Georgia, concentrations were recorded east of St. Simons and Sapelo Islands and east of Savannah. Off the Carolinas, extensive concentrations were located south of Cape Romain in South Carolina, and south and southeast of Cape Fear in North Carolina.



## 'Oregon' Explores Florida's Scallop Grounds

BCF's exploratory fishing vessel Oregon returned to St. Simons Island, Georgia, on August 30 after 10 days of scallop explorations off Florida's east coast. (Cruise 132, 8/21-30/68.) This was the eighth in a series of industrial development cruises to keep an up-to-date check on Cape Kennedy calico scallop (*Pecten gibbus*) grounds.

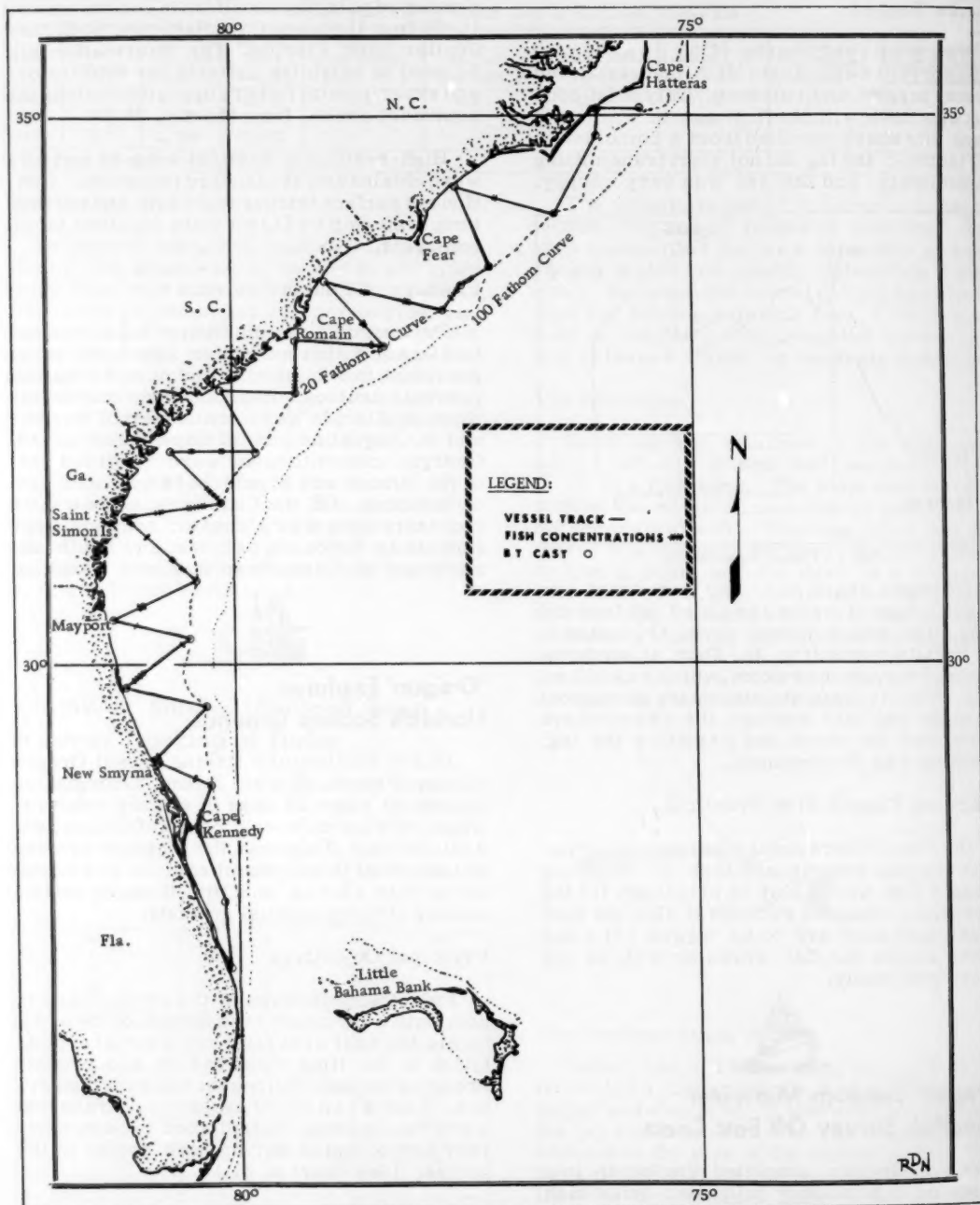
## Principal Objectives

Principal objectives of the cruise were to complete a 12-month assessment of the area, locate the best areas for commercial exploitation in the time available, and provide dredging demonstrations for industry observers. Four standard assessment transects were run in areas established in September 1967 and occupied during each cruise in the series. (See chart p. 37.)

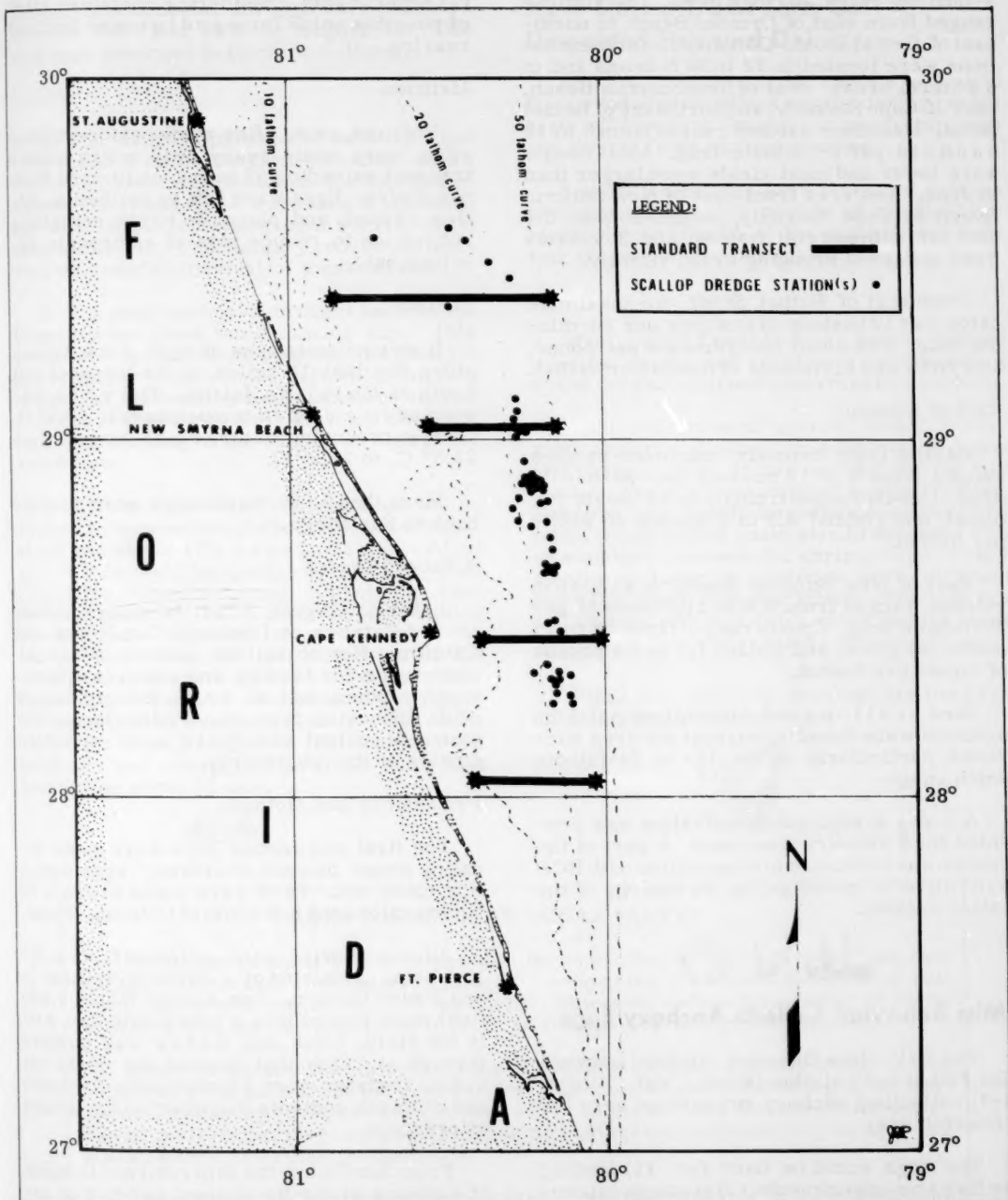
## 104 Dredging Stations

A total of 104 dredging stations were occupied with 8-foot tumbler dredges fitted with





R/V Oregon, Cruise 131, July 15-26, 1968.



R/V Oregon Cruise 132, August 21-30, 1968.

2-inch bag rings, 20 rings deep. The stations ranged from east of Ormond Beach to north-east of Bethel Shoal. Commercial concentrations were located in 22 to 26 fathoms and in 3 general areas: east of New Smyrna Beach, east of Cape Kennedy, and northeast of Bethel Shoal. Maximum catches ranged from 8 to 19 bushels per 30-minute drag. Meat counts were lower and meat yields were larger than in June. The area from east of New Smyrna Beach to Cape Kennedy continued to be the best for commercial fishing, and 2 vessels were observed dredging in the vicinity.

Northeast of Bethel Shoal, the maximum catch was 12 bushels of scallops per 30-minute drag. The count was 80 meats per pound, and yield was 3.5 pounds of meats per bushel.

#### East of Kennedy

East of Cape Kennedy, maximum catches ranged from 6 to 19 bushels per 30-minute drag. Counts ranged from 50 to 68 meats per pound, and yielded 3.5 to 5 pounds of meats per bushel.

East of New Smyrna Beach, maximum catches ranged from 6.6 to 11.8 bushels per 30-minute drag. Counts ranged from 55 to 75 meats per pound, and yielded 2.7 to 5.5 pounds of meats per bushel.

Seed scallops and subcommercial-size scallops were found throughout the area surveyed, particularly in the 16- to 24-fathom depth range.

A 1-day dredging demonstration was provided for 6 industry observers. A part of the cruise was conducted in cooperation with BCF biologists investigating the biology of the calico scallop.



### 'Miss Behavior' Collects Anchovy Eggs

The R/V Miss Behavior cruised between San Pedro and Catalina Island, Calif., August 6-8, collecting anchovy or sardine eggs for research use.

The eggs would be used for: (1) feeding behavior experiments; (2) electron microscope studies of developing chloride cells within the epidermis of anchovy and sardine;

(3) experiments considering container sizes of possible value for sardine and anchovy rearing.

#### Methods

Net tows, using a fine mesh net for anchovy eggs, were made every 5-10 miles along a transect extending 35 miles southward from San Pedro. Eggs were left in collection bottles, capped, and placed in boxes containing bottled ice to reduce rate of embryonic development.

#### Results

High concentrations of eggs were found along the last 10 miles of the transect just south of Catalina Island. The area was marked by a drop in temperature to 20.5° C. from surrounding water, which ranged from 21.3° C. to 22.0° C.

More than 7,000 viable eggs were brought back to San Diego.

#### A Second Cruise

Later in August, Miss Behavior cruised around Catalina and between San Pedro and Catalina. Her objectives were to obtain anchovy eggs for feeding and electron microscope studies, and to obtain freshly seined adult anchovies from San Pedro Harbor for stomach-content analysis and respiration studies at the laboratory.

#### Procedures and Methods

The first and second days were spent locating dense patches of anchovy eggs with a fine mesh net. Tows were made within a 20 square mile area just south of Catalina Island.

Adult anchovies were collected from a set just being completed by a commercial boat in San Pedro Harbor. Ten scoops (about 1,500 fish) were placed into a removable bait well in the stern; fresh sea water was pumped through it. Fish that jumped out of the net during transfer were immediately dissected and stomach contents examined under a light microscope.

From San Pedro, the ship returned to south of Catalina where the densest patches of anchovy eggs had been found. Fifteen tows were made and collected eggs were transferred to

polyethylene buckets. All eggs were collected between 0200 and 0430 on August 22. The ship then returned to port immediately.

#### Results

1. The densest patches of anchovy eggs were found 8 miles south of Catalina. About 20,000 eggs were collected on the morning of August 22. Most eggs were newly spawned and still in early development when brought back to the lab. Preliminary results indicate very successful survival of these larvae.

2. All adult anchovies brought back to the fishery were dead the following day. This procedure is not recommended until major alterations are made to the bait well. Serious clogging of the drain by dead anchovies caused overflow of water into the boat. It necessitated frequent clearing of the drain and decreased water flow.

3. Stomach contents from adult anchovies showed a composition of about 90% unicellular algae and about 10% crustaceans. Algal genera included Platymonas sp., Phaeocystis, Gonyaulax, Coscinodiscus, Rhizolenia, and many small (less than 5 microns) unicellular green algae. Digestion of green algae was fairly complete in the last one-third of the intestine, although both diatoms and dinoflagellates seemed unaffected. Gonyaulax was found still alive in this last portion of the intestine. Zooplankton included various medusae and copepods. Average adult fish length was about 82 mm.



## New Shrimp Trawl Sorts Out Unwanted Fish and Debris

A shrimp trawl designed by BCF's Seattle Base produced excellent results during recent tests off Newport, Oregon, in separating fish and debris from shrimp catches.

Several 30-minute tows produced catches averaging about 700 pounds of nearly pure shrimp; less than 3% of the catches was bottom trash and unwanted fish.

#### How Trawl Works

Most small flatfishes, larger bottom species, smelt, and urchins are screened out by the net and returned unharmed to the ocean.

A unique feature of the trawl is that it consists entirely of wings, codend, trash chute, and chafing gear. It has neither the top nor bottom panels of conventional shrimp trawls. Because only minute amounts of webbing are used, construction costs should be about 50% of standard commercial shrimp nets. Practically no labor is needed to sort catch and very few small fish are killed. Preliminary indications are that catch rates should equal or exceed those of present commercial gear.

Plans are ready to demonstrate the gear to commercial fishermen.



### WHAT MAKES THE OCEAN SALTY?

For many years it was assumed that the ocean began as fresh water and that the age of the earth could be determined by comparing the annual increase of salt from rivers with the total salt in the ocean. However, radioactive dating of rocks indicates that the earth is much older than the age derived by such method.

It is now generally believed that the primeval seas were initially salty, having dissolved their salts from the rocks underlying their basins. Breaking up of continental rocks by frost and erosion has added to the salts of the sea, but the dissolved material in rivers contains higher percentages of carbonates than does sea water, where chlorides predominate.

The saltiness of the oceans is undoubtedly increasing, but it is a slow process which has been going on for hundreds of millions of years. ("Questions About The Oceans," U. S. Naval Oceanographic Office.)

## ARTICLES

### "NO CONTEST" ON THE FISHING GROUNDS

By Commander Adrian L. Lonsdale,  
U. S. Coast Guard

The Soviet Union has won the battle of the fishing grounds. Their boats are presently reaping rich harvests close to U. S. shores. Using task force operations and the latest fishing techniques, they are exploiting to the limit traditional American fisheries.

In ten years the Soviets have passed the United States in fish production and now occupy fourth place, exceeded only by Japan, Peru, and Communist China. In fishing fleet strength, the Soviets rank third behind Japan and Norway. Until the late 1950s, the United States ranked second only to Japan in size of catch. Now the United States is in fifth place and is in danger of being relegated to sixth by Norway.

Russia increased her fish production from 2.5 million metric tons in 1954 to more than 6 million tons in 1966. This is about 9.5 per cent of the world's catch. Soviet goals call for a yearly production of 8.5 million tons by 1970. It is conceivable that they could lead the world in fish production within the next decade.

Meanwhile, U. S. fish production remains static--about 3 million metric tons annually, or about 5 per cent of the world catch.

Under their present five-year program (1966-1970), the Soviets will invest about \$650 million per year in their fishing industry and fleets. This rate is two-thirds more than they spent in the previous five years (1960-1965). They will add 1,500 vessels to their fleets, presently estimated at more than 18,000 motor vessels. New acquisitions will include 250 large stern trawlers from Polish and East German shipyards, and 145 refrigerated fish carriers, factory ships, and floating factories from West Germany, Japan, and Holland.

Before 1948, the Soviet fishing industry was crude and confined to inland and coastal waters. The over-fished areas could not possibly support the need for protein at home.

Soviet agriculture fell far short of goals. Economic studies showed that fishery products could be produced with 25 to 30 per cent less capital investment than the same quantity of meat products. To produce one ton of cattle costs more than twice as much as one ton of fish. Further incentives for expansion of offshore fisheries were the existence of Baltic ports and skilled fishermen which had been brought into the Soviet sphere as part of newly acquired Satellite countries.

Today, 90 per cent of Soviet deep sea fishing takes place too far from home for fresh fish operations. With few overseas bases, they were forced into developing methods for processing the catches at the fishing grounds. This has resulted in a steady increase in the size and capability of Soviet trawlers and the development of auxiliary ships capable of supporting a large fleet thousands of miles from home for months at a time.

Soviet fishing operations need not be justified on an economic basis. Their objective is volume, but they try to get the fish to the consumer as cheaply as possible. Fish are generally delivered to the retailer in the container in which they were packed at sea. Bulk salted fish may be delivered in 200-pound barrels and frozen fish in 66-pound cartons. The consumer pays about 25 cents per pound for it.

Prices are established by a central price bureau after consultation with fishery experts. Labor, operating, maintenance, and amortization costs are used. If they are covered by the price received, the voyage is considered profitable. When a voyage is unprofitable, subsidies are paid by the state. This ensures an adequate protein supply for Soviet citizens.

Soviet fish production is controlled by the State Committee of Commercial Fisheries Production. Under the State Committee is the Main Fisheries Administration. It controls fleets at sea through five regional



subdivisions headquartered as follows: Western in Riga, Northern in Murmansk, Black Sea in Sevastopol, Caspian in Astrakhan, and Far East in Vladivostok.

A fishing fleet may consist of as many as 100 trawlers controlled by a base chief on board one of two base ships. He receives information twice daily from the trawlers concerning the number of trawls made and amount of fish caught by species. After correlating this data with that received from trawlers on scouting missions, he may direct vessels to more lucrative grounds. The information is also used to schedule the offloading of catches to transports.

The Soviets are constantly adding more sophisticated ships to their fleets and updating their fishing procedures. Vessels operating on our side of the ocean are new, having been built in the late 1950s and later.

Side-trawlers range in size from 125 feet to about 200 feet long. Smaller ones stow fish in a 30 per cent salt solution in barrels. When the catches are delivered to one of the base ships, the fish are sorted and repacked in a 15 per cent salt solution in barrels and stowed at a temperature of 18 degrees F. Many of the larger side-trawlers can process and refrigerate part of their catches prior to delivery.

Fish-factory-trawlers range in size from 250 to 300 feet long. The largest ones have a cargo capacity of approximately 1,400 tons. They carry crews of from 96 to 102, usually including about six women. Trawls are operated from a ramp in the stern. The ships are more efficient than side-trawlers in retrieving their catches and can make large hauls of more than 15 tons per set. Daily quotas range from 25 to 50 tons depending on the size of the vessel and the type of fish being caught. They process their own fish and deliver it to a transport with no further handling required. In addition to processing frozen and salted fish, they may also manufacture fish meal and oil. They are equipped with filleting machines for processing haddock, cod, and ocean perch.

Fish transports are refrigerated passenger-freighters about 500 feet long. They act as base ships when with the fleet. Their turn-around time is about 25 days, depending on how long it takes to be loaded. They are comfortable ships with pleasant accommodations and are manned by a crew of about 200, including 40 women. They have doctors, well-equipped medical and dental facilities, two 12-bed hospital wards, and an outpatient clinic.

Ocean-going tugs about 200 feet long usually accompany the fleets. They are equipped



The "Konstantin Sulzhanov," a passenger-freighter, was converted to a fish factory ship for crab fishing in the Bering Sea.

to handle emergencies at sea such as towing, salvage, and repairs. Their doctors (usually women) render medical assistance.

Passenger ships and tankers may also be found from time to time bringing replacement crews and fuel.

A fishing vessel may be operated continuously for six months or more before being sent home for repairs and maintenance. The crews are rotated every three to four months. While at sea, they eat four meals a day, and entertainment includes motion pictures which are shown twice daily in the larger ships.

With most logistic operations taking place at sea, the Soviets have developed to a high degree the art of bringing ships alongside each other while one is at anchor. With clusters of very large pneumatic fenders, Soviet fishermen can conduct transfer operations in a gale-force wind.

Navigation is done with sextant, Fathometer, radio direction finder, and by dead reckoning. Larger vessels are equipped with Loran receivers. Smaller boats, when close enough to land, use radio direction finding on shore stations as a primary means of navigation. When too far from shore, DF bearings are taken on the base ships which anchor about 30 miles apart. The base ships fix their positions using Loran and celestial observations.

The base pay of a member of the fleet is the same as for an equivalent job of equal responsibility in the homeland. To compensate for the long periods away from home, he is entitled to a 150 per cent bonus for sea pay. Only 80 per cent of the bonus is guaranteed and the remaining 20 per cent depends on whether the fishing vessel catches her quota. The value of fish in excess of the annual quota is divided into shares, of which the captain gets two, other officers something less, and the crew gets one share each. On the average, Soviet fishermen earn about 300 rubles (\$333) per month.

Leave is accrued at the rate of 42 days per year for the captain and 36 days for a crew member per year, with pay. The rate of pay for leave is based on the average of the individual's pay and bonuses for the previous year. Each Sunday at sea counts for one more day of leave with pay. While on board ship, the fishermen are entitled to free food and medical services.

The Soviets are presently conducting their fisheries research on a world-wide basis. Their fleets are fishing in most of the major oceans of the world. Over the years their operations have progressed steadily southward.

In 1966, the Soviet Union established a fishing fleet command in Havana, Cuba. The base there includes ship repair yards, cold storage plants, canneries, and warehouses. Extensive docking facilities can service more than 100 Soviet and Cuban ships.

This new stepping-stone in the Caribbean facilitates exploitation of untapped marine resources in the Western Atlantic, particularly off the coasts of Central and South America. Under-fished species there are being harvested by the Soviets and by Cubans who are assisted by Soviet technicians. South American countries, whose only concern for their fishing grounds used to be the appearance of an occasional U. S. shrimper or tuna boat or a fleet of Japanese tuna boats, have had their complacency shattered as Soviet, Cuban, Yugoslav, and East German trawlers have moved into traditional fishing grounds.

The Northwest Atlantic fishing interests of the United States and Canada suffered the same trauma when, in 1961, a small number of medium-class Soviet trawlers began exploratory fishing on Georges Bank off New England. In 1962 and 1963, Soviet vessels there increased to 300-400 during peak summer months. During 1964 and 1965, the number declined to between 150 and 180 vessels during the peak season, but their catches continued to increase from 68,000 tons in 1961 to 300,000 tons in 1965. The size of the catch, then, is not proportional to the number of Soviet vessels fishing in the Northwest Atlantic. There has been a rapid increase in fish production due to advanced design and increased capacity of later model trawlers. Also, fisheries research has provided valuable data for improving equipment and techniques, and determining fish behavior and oceanography, thus allowing timely adjustments according to fish distribution and environmental changes.

Although the Northwest Atlantic region equals less than one per cent of the world's ocean area, it produces 11 per cent of the world's fish directly consumed by humans. Almost all of the catch is prime, high-grade fish in great demand as human food. Very little is reduced to meal and oil or other by-products. In the area, total landings by all

countries have increased from 1.8 million metric tons in 1955 to more than 3 million in 1966. However, U. S. fishermen have not shared in the increase; in fact, their tonnage has dropped during the past ten years from 550,000 metric tons to 326,000.

Alaskans have been upset since 1959 when the Soviet Union began operating large fishing fleets in the Bering Sea and in the Gulf of Alaska. In peak periods they have had 400 vessels in those waters catching herring, perch, flounder, sole, cod, pollock, king crab, shrimp, halibut, and whales. Fifty research ships and 300 Soviet scientists have probed the Pacific as far south as New Zealand and Australia. Fisheries research has been concentrated in the Japan, Okhotsk, and Bering Seas; the North Pacific Ocean off Canadian, U. S., and Mexican shores; the New Zealand Plateau and the Great Australian Bight; and the Indian Ocean. They have also conducted studies of the resources southeast of Latin America.

As a result of their discoveries, the Soviet Far Eastern fishing fleet expanded operations into the waters off British Columbia, Oregon, Washington, Baja California, and into the South Pacific and Indian Oceans. Off the Pacific Northwest Coast in 1966, they landed over 130,000 metric tons of an untouched Pacific hake resource.

As the Soviets move into new areas, their scientists must work hard to develop techniques for handling new species of fish they expect to catch. One Soviet innovation uses sounds of predators to force fish to the bottom where they are easily caught by a bottom trawl. Soviet scientists claim that by forcing the fish down, they can increase the effectiveness of their fishing gear between 300 and 500 per cent. This is only a short step from herding fish into a net, trap, or fish pump.

In fact, by using cages, lights, and electric current, the Soviets in the Caspian Sea are herding fish into cages where they are pumped onto a vessel. They say the cost of the fish pump operation is about one-third that of a net operation.

The Soviets have developed a series of techniques for improving trawl catches. The simplest is to hit the fish with an electric charge as they enter the mouth of the trawl. The fish are also prevented from escaping by a series of clever optical illusions woven into the net.

The Soviets claim that by using acoustical signatures, they can distinguish types of fish. For instance, they say they can distinguish between types of tuna by the sounds of their fins and tails as they move through the water.

Before 1950, Soviet fishing methods were considered crude when compared to ours. Now the situation is reversed, and present Soviet successes are only a prelude to greater activity close to our shores. Not only will Soviet activity increase, but the growing fishing industries of other nations, such as Poland, East and West Germany, Romania, Canada, Japan, and Cuba, will concentrate more and more of their efforts on North American fisheries resources.

Marine resources, fortunately, are renewable. But they are not inexhaustible. With any species there is a maximum level that can be harvested on a sustained basis. Fortunately, in some areas, the fishing nations are working together to prevent the depletion of fishery resources. They are concerned and in most cases honor conservation treaties. Many agreements are in effect in both the Atlantic and Pacific Oceans. Trade-offs are often required, as in recent agreement whereby the Soviets will limit their catch off the mid-Atlantic states. In return they obtained concessions enabling them to conduct at-sea transfer operations in sheltered loading zones off Long Island and New Jersey.

The consumption of fish products in the United States has increased from 7 billion pounds in 1955 to about 13 billion in 1966. This rate is expected to double in the next 20 years. The potential yield from waters adjacent to the United States is estimated at about 22 billion pounds annually, but the U. S. catch seems to be stagnated at about 5 billion pounds per year. The rest is imported.

Compared with the industrially organized Soviet fishing industry, our fishing activities are fragmented, and most are managed by small independent operators. There are about 130,000 U. S. fishermen operating 65,000 boats of less than five tons and 12,000 larger vessels. They supply fish for about 4,000 establishments employing about 57,000 workers.

The promotion of a vigorous fishing industry in this country requires public awareness of the country's needs and the desire to maintain a place among the leading fishing nations of the world. Presently the Bureau of Commercial Fisheries spends only \$28 million

annually on research. The National Academy of Sciences predicts that rational development of U. S. domestic fisheries could double our production in 15 years and the growth of U. S. overseas fisheries could be quadrupled by 1980. Scientists say that fisheries-oriented

science could add \$2 billion a year to the gross national product within ten years.

The U. S. fishing industry needs resuscitation. Only a radical change in the public attitude can revive it--something akin to our urge to get to the moon first is required.



## Progress of Fishing Industry and Soviet World Role Outlined

Shortly after the opening of the International Exhibition, "Inrybprom-68," in Lenin-grad on August 6, Nikolai Uporov, Deputy Minister of Fishing of the USSR, released this statement on the progress of the Soviet fishing industry--and on Soviet cooperation with other nations in fishing matters:

"Last year the Soviet Union caught 6,500,000 tons of fish and marine animals. The Soviet Union occupies third place in the world for fish and marine animal catches, and is on the list of the five biggest fishing countries in the world. The rate of increase in the amount caught can be seen from the fact that the catch in the first six months of this year was approximately equal to the total taken in the whole of 1961.

"The Soviet fishing industry has a powerful modern fleet with an unlimited range of operation. It holds second place in the world as regards the number and power of the ships. The fleet has nearly 20,000 powered boats, including vessels for catching, processing, transporting and refrigerating. It has ships for research work and prospecting, and life-boats and other auxiliaries. The USSR has the biggest flotilla in the world of large-size refrigerator trawlers. These are unique

floating factories. They deliver finished products to the ports and this increases the profitability of the operation considerably. Three or four trawlers of this type can meet, in one expedition, the demand for fish of a town with a population of a million.

"The modern Soviet fishing ships are equipped with radio-electronic instruments, which enable the boats to keep strictly to the desired route, detect shoals of fish, and maintain ship-to-ship and ship-to-shore contact. The search equipment developed with the use of echo-sounders is widely used to detect deep-sea and surface fish, whales and crabs, and to control the operation of trawl nets. Our fishing fleet has Soviet-made apparatus for horizontal and vertical prospecting, which gives the accurate position and density of fish shoals. Thanks to this, we achieved and mastered, for the first time in world practice, varied depth target trawling. This was done in 1956.

"The manpower of our fishing industry includes 60,000 specialists with higher and secondary technical education, navigators, mechanics, electricians, specialists in fish catching and processing, and whalers. The Fishing Ministry runs five higher schools and 24 secondary schools.



"The Soviet Union conducts active fishing and the catching of other marine animals in different parts of the world oceans. In this connection the Soviet Union is cooperating on an international level with other countries. It is a party to 30 intergovernmental agreements on fishing. Our country is cooperating closely and extensively with European socialist countries which have well-developed modern ocean-faring fishing fleets. The cooperation covers practically all the main fields of theory and practice relating to the fish industry, such as estimation of the reserves of commercial fish, the technology of catching and of the fishing fleet itself, of fish processing, and so on. Specialists from socialist countries jointly compile annual fishing forecasts, and these are used mainly for the siting of fishing fleets in the areas of operation. Reciprocal visits are made by specialists to exchange experience. An intergovernmental agreement on cooperation in the development of marine fishing has been concluded between the USSR and Cuba.

"The USSR is giving technical assistance to a number of developing countries, among them the United Arab Republic, the Republic of Guinea, the Republic of Senegal, and the Somali Republic. Soviet specialists share their experience in developing oceanic fishing, in increasing the productivity of internal reservoirs, and in the training of native personnel for the fishing industry.

"The USSR and the countries with well-developed fishing industries, such as Japan, Norway, Britain and France, cooperate in the field of fishing on the basis of mutual interest in preserving the fish resources of the world oceans. The Soviet Union strictly observes the obligations assumed under intergovernmental agreements and is fully prepared to further develop cooperation with all the countries interested in the rational utilisation of the resources of the oceans of the world.

"In the light of all this we regard the International Exhibition "Inrybprom-68" as an effective instrument in extending and strengthening this cooperation." ("Moscow News," Aug. 10.)





## THE ROLE OF INTERNATIONAL AGREEMENTS IN ALASKAN FISHERIES

By Ronald C. Naab\*

Foreign fleets fishing in international waters off Alaska are capable of depleting the resources supporting Alaska's largely inshore fisheries. Recognizing this threat, the United States has increasingly utilized international fisheries agreements, particularly during the last few years, to provide safeguards essential to the U. S. fisheries off Alaska. Policing these agreements by joint Coast Guard-Bureau of Commercial Fisheries patrols has been stepped up to keep pace with the increased enforcement responsibilities and growing foreign fishing efforts. As nations of the world increase their harvests of protein from the seas, international agreements will become more important in protecting U. S. interests in the vast fishery resources of the Alaskan area.

Marine resources supporting Alaska's foremost sustaining industry, commercial fisheries, are highly vulnerable to depletion by fleets operating in international waters adjacent to Alaska's shores. The species traditionally most important to Alaska--salmon, halibut, king crab, and fur seal--spend a major part of their lives in waters of the high seas beyond U. S. jurisdiction. While in these offshore areas, these migratory animals, in the absence of international safeguards, could be intercepted by fishermen of any nation before reaching Alaska's largely inshore fisheries.

The same threat hangs over the under-utilized fishery stocks that offer the greatest potential for development by the U. S. fishing industry. These include species already becoming more important to Alaska's fisheries--tanner crab, shrimp, and scallops--as well as stocks likely to be developed in the future: pollock, ocean perch, flounders, and sablefish.

The U. S. has long recognized this danger to Alaskan fisheries and has increasingly sought to provide protection by international agreements. The urgent need for such protective agreements was accelerated greatly by the alarming growth of Japanese and Soviet fisheries off Alaska during the past decade

(figs. 1 and 2). Since 1964, the number of such agreements and associated U. S. laws has nearly trebled, climbing from 4 to 11. Through these agreements, harvesting by foreign fishermen of species essential to the Alaskan fisheries either has been controlled or prohibited. The gravity of this situation is evidenced by 1966 statistics. These show the species protected by such agreements provided 96 percent of the value of Alaska's commercial fisheries manufactured products, which had a total wholesale value of over \$200 million.

### DEVELOPMENT OF AGREEMENTS

The pattern of increased protection afforded the U. S. fisheries can be pictured by tracing the development of international agreements and associated laws affecting the Alaskan area.

#### North Pacific Fur Seal Convention

This was the first, and is perhaps the best known, international fishery convention that followed a serious decline or depletion of fishery resources of concern to several nations. It is a notable example of how nations, faced with a mutual conservation problem, worked together to restore and maintain a resource so that it provided a sustainable annual yield.

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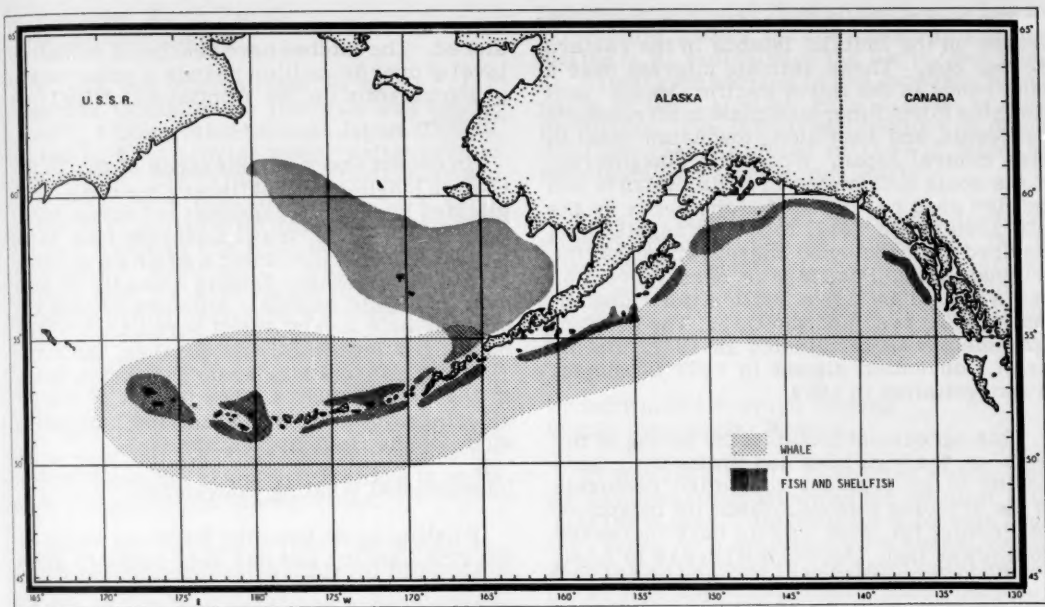


Fig. 1 - Japanese fishing areas off Alaska. (Excluding high seas salmon fishing areas.)

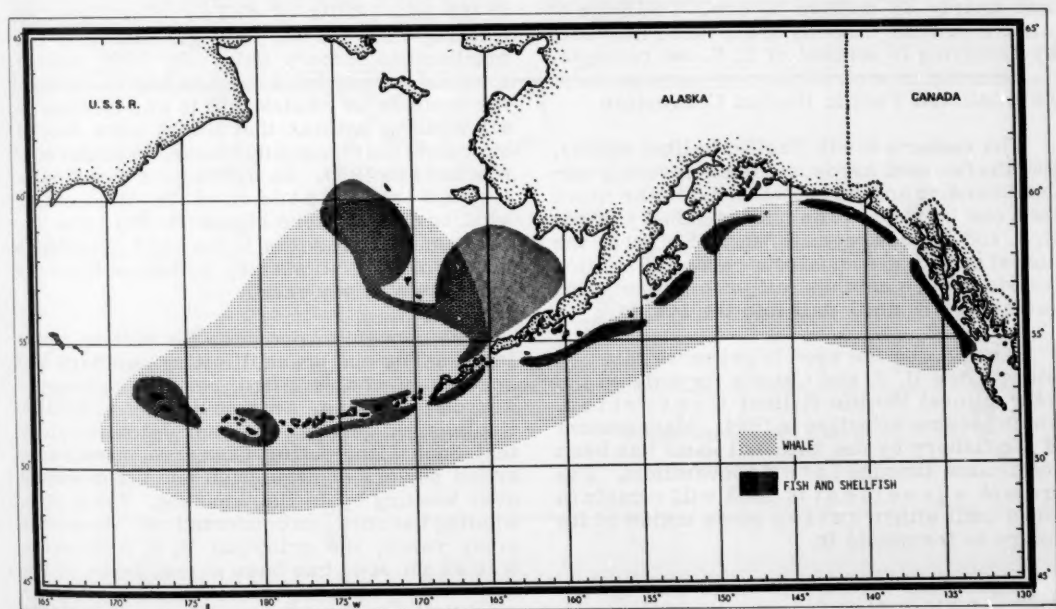


Fig. 2 - Soviet fishing areas off Alaska.

The main North Pacific fur seal herd breeds on the Pribilof Islands in the eastern Bering Sea. These animals migrate over a wide range in the North Pacific Ocean; east along the North American coast to off southern California, and west along the Asian coast to near central Japan. Wholesale slaughtering of the seals both on the breeding islands and the high seas had decimated the herds by the late 1800's. In 1911, following negotiations inspired by concerned conservationists, the original North Pacific Fur Seal Convention was signed by Great Britain (for Canada), Japan, Russia, and the U. S. The original agreement was terminated in 1941. An Interim Convention signed in 1957 is subject to renegotiation in 1969.

This agreement prohibits the taking of fur seals on the high seas and limits their harvesting to government-controlled removals on the breeding islands. Since its inception, the Pribilof fur seal herds have increased from fewer than 150,000 animals to about 1,750,000 in recent years.

During 1960-67, the average yearly harvest from the Pribilofs was 65,800 seals. The U. S. share of the proceeds from these pelts was nearly \$3 million a year. The State of Alaska profits directly from these harvests by receiving 70 percent of U. S. net receipts.

#### International Pacific Halibut Convention

The eastern North Pacific halibut stocks, like the fur seal herds, declined severely under intensive and unregulated fishing by more than one nation. The halibut fishery of the U. S. and Canada began in 1888. By 1915, the annual catch had soared to a record 69 million pounds. Then catches fell precipitously and remained low until well into the 1930's.

Recognizing the need to preserve this resource, the U. S. and Canada formulated the International Pacific Halibut Convention, which became effective in 1924. Management of the fishery by the two nations has been continuous through later conventions. The present agreement of 1953 will remain in force until either nation gives notice of its desire to terminate it.

Regulations formulated under this agreement establish fishing areas and seasons, catch quotas, legal types of fishing gear, and minimum sizes of fish that can be taken. Under the careful management of the two-nation

commission, the halibut stocks have been restored. The catches have reached a sustained level of over 60 million pounds a year--taken predominantly on the Continental Shelf off Alaska.

In recent years, maintenance of the U. S.-Canada longline halibut fishery has been complicated by growing Japanese and Soviet trawl fisheries. These trawl fisheries take some halibut incidental to their catches of other groundfishes, which amount annually to well over a billion pounds. Although halibut represent only a very small percentage of the Soviet and Japanese trawl catches, the cumulative removals may endanger maintenance of the halibut stocks. The impact of the incidental trawl catches is receiving increasing study by the Halibut Commission.

#### International Whaling Convention

Whaling as an industry began as early as the 12th Century and has deep roots in early U. S. history. The whale populations of the world's oceans have been depleted progressively--first those of the Northern hemisphere and, more recently, the southern seas. The declines were hastened by development in the mid-1920's of pelagic or high-seas whaling with the harpoon gun and the large mechanized factory ship. By 1930, excessive and unrestricted catches had so reduced the number of whales that it was obvious to all whaling nations that limits were needed to protect the remaining stocks. A conference was held in 1930. An agreement was finally reached and adopted in 1937. Most major whaling nations were signatories to later revisions, which resulted in the 1946 convention now in force. Nations may withdraw from the convention in any year.

The convention provides for setting whaling seasons and areas, limiting numbers and species of whales killed, recommending research programs, and reviewing scientific findings. In general, the convention provides that each Contracting Government exercise broad powers of regulation and enforcement over whaling by its flag vessels. Since U. S. whaling has not been conducted off Alaska for many years, the principal U. S. role in the Alaskan area has been surveillance of the large foreign whaling fleets to determine their compliance with the international regulations.

## International North Pacific Fisheries Convention

In 1953, the International North Pacific Fisheries Commission (INPFC) was established by a Convention between Japan, Canada, and the U. S. to provide major safeguards to three species vitally important to Alaskan and other North American fishermen. The safeguards were provided through the introduction of a new concept in international fisheries regulation--"abstention." This concept recognizes that the high levels of productivity maintained in some fisheries are the result of long and continuous conservation efforts. In view of these efforts, the Convention provides for abstention from fishing these stocks by some member nations where it can be shown that, historically, these have not fished the stock--and that the other member nations are fully utilizing the resource and have it under study and scientific management.

Under the terms of this Convention, the Japanese currently abstain from fishing for salmon in either the Bering Sea or North Pacific Ocean east of the "abstention line" of long. 175° W. (intersects the central Aleutians), and the Canadians abstain from fishing salmon in the Bering Sea east of the same line. Further, the Japanese also refrain from

fishing for halibut of North American origin in Convention waters off the coasts of Canada and the U. S., exclusive of the Bering Sea (fig. 3). Fishing for herring by the Japanese along parts of the Canadian Pacific coast is also prohibited. The INPFC will continue in force until one year following notice of intent to terminate by a Contracting Party.

This Convention has been criticized and described sometimes as inadequate. But it does protect nearly all the North American salmon stocks, including most major runs in Alaska, as well as the eastern Pacific halibut populations of great importance to the U. S. and Canada.

## Prohibition of Foreign Fishing Within Territorial Waters

In May 1964, the U. S. enacted Public Law 88-308, commonly known as the Bartlett Bill. This law makes it unlawful for a foreign fishing vessel, or a master of such vessel, to engage in the fisheries in U. S. territorial waters or to take any Continental Shelf fishery resource that belongs to the U. S., except as provided by the Act or by an international agreement to which the U. S. is party. The Act establishes penalties, provides for seizure and forfeiture of a vessel or its catch or

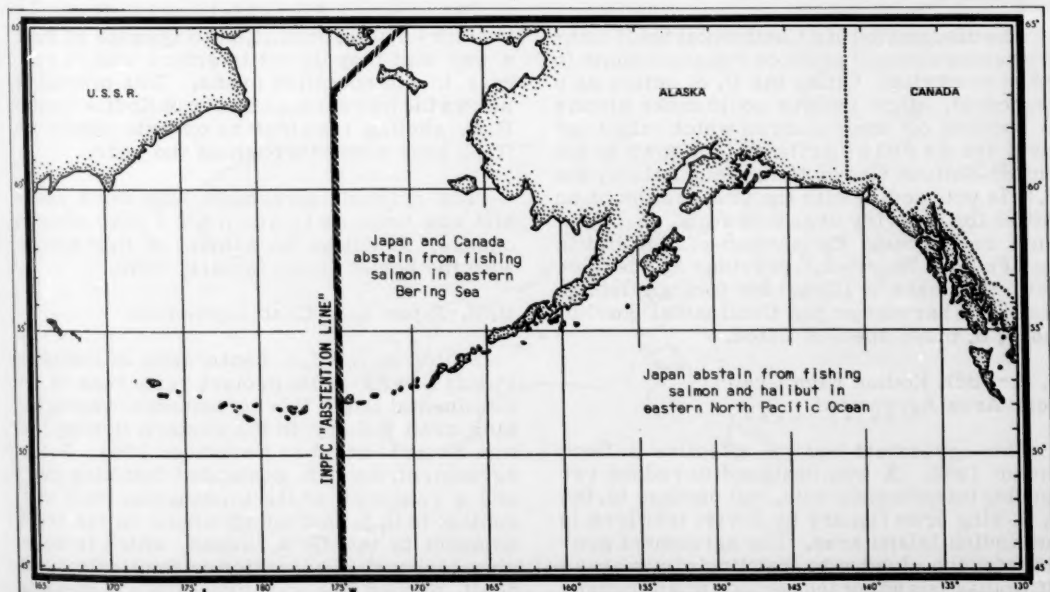


Fig. 3 - "Abstention" areas established by the INPFC.



gear, and delegates enforcement responsibility and enforcement powers. It was enacted following increasing entries by foreign fishing vessels into the territorial waters off Alaska. It had become evident that existing laws were inadequate to make abundantly clear that foreign vessels are denied the privilege of fishing within U. S. territorial waters and, further, that there were no effective sanctions to punish violators.

This Act defines "fisheries" as the "taking, planting, or cultivation of fish, mollusks, crustaceans, or other forms of marine animal or plant life." Enactment of Public Law 90-427 in July 1968 broadened the definition of fisheries to include support operations.

This law provides the legal framework for the U. S. to designate fishery resources of the Continental Shelf and, thereby, to regulate their harvest by foreign nations. The Continental Shelf fishery resource is defined as including "living organisms belonging to sedentary species; that is to say, organisms which, at the harvestable stage either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil." This language conforms to that in the United Nations Convention on the Continental Shelf, which became effective in June 1964.

The designation of a Continental Shelf fishery resource could produce repercussions in other countries. Citing the U. S. action as a precedent, other nations could make claims to species off their shores which might not meet the precise criteria laid down in the United Nations Convention. Nonetheless, the U. S. is proceeding with the preparation of an initial list of living organisms that qualify as Shelf resources. Publication of this list in the "Federal Register," provided by the 1964 Act, will make it illegal for foreign fishing vessels to harvest on the Continental Shelf of the U. S. those species listed.

#### U. S.-USSR Kodiak King Crab Gear Area Agreement

This agreement became effective in December 1964. It was designed to reduce recurring interference with, and damage to, the U. S. king crab fishery by Soviet trawlers in the Kodiak Island area. The agreement provides for the closure to trawling of six areas off Kodiak Island during periods when concentrations of king crab pots occur there (fig. 4).

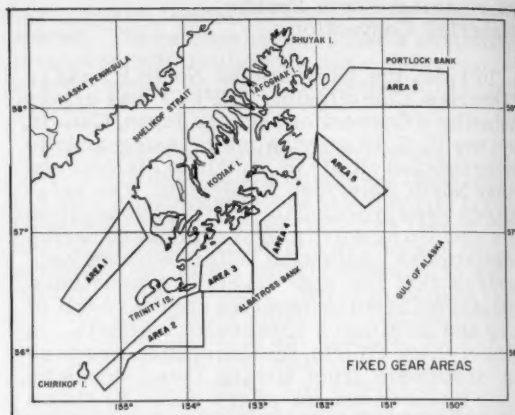


Fig. 4 - Fixed fishing gear areas established by 1964 U.S.-USSR agreement.

These areas were established in accordance with the past pattern of the U. S. king crab fishery off Kodiak Island. The areas extend well beyond the 12-mile fishery limit of the U. S. and have provided a high degree of protection for U. S. fishing gear. Since this agreement became effective, conflicts in the Kodiak area have been greatly reduced. There have been no documented Soviet violations.

The agreement provided that small shrimp trawlers will be permitted to operate in such a way that they do not interfere with fixed gear in the specified areas. This provision allows the increasing number of Kodiak-based U. S. shrimp trawlers to operate within the fixed gear areas throughout the year.

The original agreement was for 3 years and has been extended for 1 year without change. It will be the subject of discussions with the Soviet Union in early 1969.

#### U. S.-Japan King Crab Agreement

Following the U. S. declaration of intent in Public Law 88-308 to protect resources of the Continental Shelf, this agreement covering the king crab fishery in the eastern Bering Sea was negotiated in November 1964. In the agreement, the U. S. contended that king crab are a resource of the Continental Shelf and subject to U. S. control anywhere on the shelf adjacent to the U. S. Japan, which is not a signatory to the Convention on the Continental Shelf, argued that king crab are a high-seas resource. The agreement was concluded



without prejudice to the positions of both parties, but Japan agreed to certain restrictions on its longstanding crab fishery in the Bering Sea.

Major features of this agreement, which protected the rapidly growing U. S. king crab fishery and safeguarded the king crab resource, included: (1) limiting Japanese catches to an annual quota; (2) providing an area north of Unimak Island where pots only may be used for king crab fishing (other types of gear may be fished for other species in this area); and (3) restricting Japanese fishing gear and methods such as minimum mesh size of tangle nets, use only of pots or tangle nets, minimum size of crabs taken, and retention only of male crab. It also permitted continuation of the longstanding Japanese king crab fishery in the eastern Bering Sea--essentially on the Continental Shelf of outer Bristol Bay.

These provisions allowed the U.S. fishermen to continue expanding their king crab fishery in the Gulf of Alaska and along the Aleutian Islands without competition from Japanese crab fleets; also the agreement enabled the expansion of the U. S. crab fishery

into an area of the eastern Bering Sea without interference by Japanese tangle nets (fig. 5).

The agreement of November 1964 was for a 2-year period and established an annual quota for the Japanese during 1965 and 1966 of 185,000 twenty-four-pound cases. The agreement was extended for 2 years in November 1966 with a provision reducing the annual Japanese catch quotas in 1967 and 1968 to 163,000 twenty-four-pound cases.

#### U. S.-USSR KING CRAB AGREEMENT

Following the agreement with Japan, a similar one was reached with the Soviets in February 1965. Its provisions were basically identical, with the exception that the Soviets' annual catch quota was less than the Japanese. The exception was based primarily on the Soviets' smaller catches and shorter history of king-crab fishing in the eastern Bering Sea. The Soviets recognized the U. S. position that king crab were a resource of the Continental Shelf over which the coastal state has sovereign rights.

This 2-year agreement protected the growing Alaska king-crab fishery and permitted

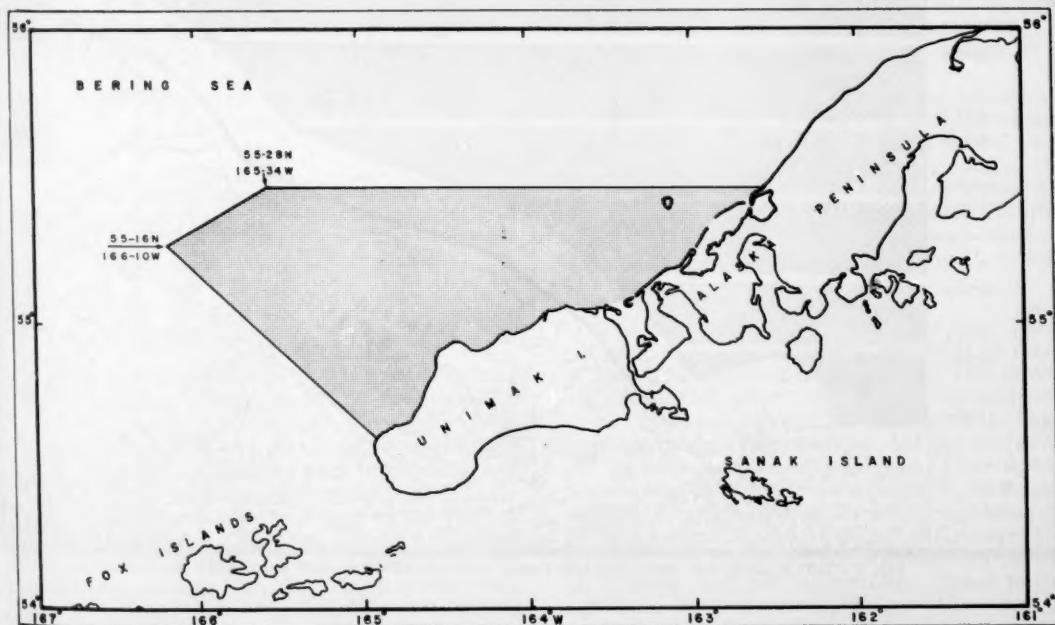


Fig. 5 - Pot fishing zone established by U. S.-Japan and U. S.-USSR king crab agreements.

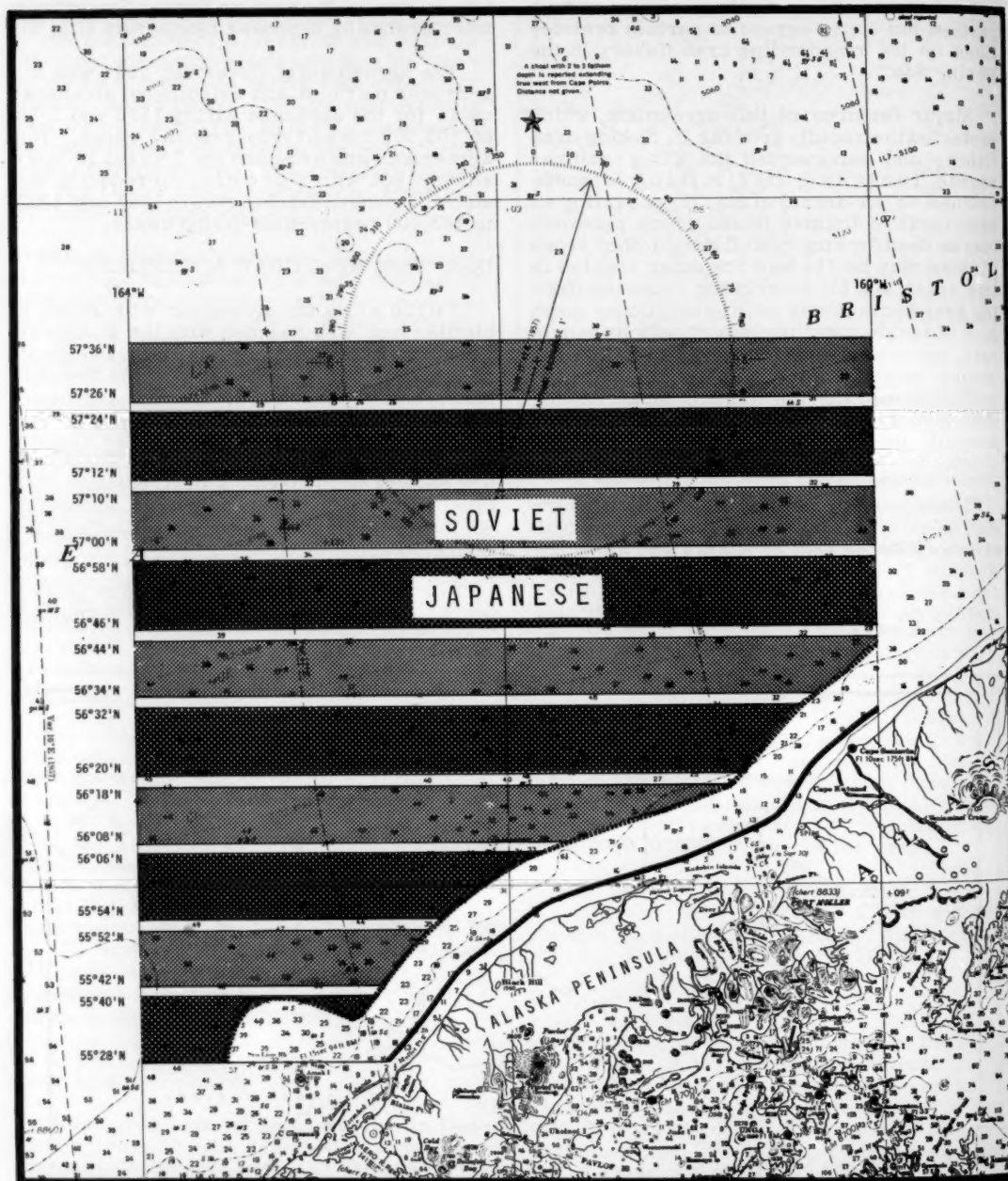


Fig. 6 - 1968 Japanese and Soviet king crab fishing areas established by 1967 Japan-USSR agreement.

the Soviet king-crab fishery off Alaska to continue only in the eastern Bering Sea. The agreement provided that in 1965 and in 1966 the Soviets could take 118,600 twenty-four-pound cases. This agreement was extended for 2 years in February 1967, with the provision that the annual pack in 1967 and 1968 would not exceed 100,000 twenty-four-pound cases.

One innovation resulting from renegotiation of this and the Japan king-crab agreements was the division of the fishing area between the Soviets and Japanese (fig. 6). The agreement between the two established specific fishing zones for each country to prevent gear conflicts. More important for the U. S., the agreement would prevent wasteful fishing methods by the two countries. In the past, Soviet and Japanese fishermen competed for better fishing areas and reserved selected regions by preoccupying them with excessive amounts of gear. Such practices resulted in excessive mortality of king crabs.

#### Regulation of Foreign Fishing Within the Contiguous Fishery Zone

Public Law 89-658, enacted by Congress in October 1966, established a 9-mile contiguous fishery zone adjacent to the U. S. 3-mile territorial sea. The law provides that the U. S. will have the same jurisdiction over fisheries within this newly created zone as it has within its territorial sea, subject to the continuation of "traditional" fisheries by foreign nations.

Shortly after enactment of the contiguous fishery zone law, the U. S. began negotiations with the foreign nations whose fisheries off Alaska might be considered "traditional."

#### U. S.-USSR Contiguous Fishery Zone Agreement

This agreement was the first resulting from the negotiations and was concluded in February 1967. The Soviets were permitted to fish within the 9-mile (3 to 12 miles offshore) contiguous fishery zone in three areas off the Alaskan coast little used by U. S. fishermen. The areas include one in the Gulf of Alaska, a second along the eastern Aleutian Islands, and a third encompassing the far western Aleutians (fig. 7). The Soviets were also permitted to conduct loading and fishing vessel support operations within the contiguous fishery zone in three small areas in the

Gulf of Alaska: (1) off Forrester Island, (2) off Kayak Island, and (3) off Sanak Island.

To reduce interference with U. S. halibut fishermen by Soviet trawlers, the Soviets agreed to refrain from fishing in international waters in two large zones in the Gulf of Alaska during the first 15 days of the halibut fishing season. The agreement also contains provisions protecting U. S. fisheries off Washington and Oregon. This 1-year agreement was extended for a second year at negotiations in late 1967.

#### U. S.-Japan Contiguous Fishery Zone Agreement

In May 1967, the U. S. and Japan negotiated a 2-year agreement permitting the Japanese to continue crab fishing in the 3- to 12-mile zone off the Pribilof Islands, trawl fishing along the Aleutian Islands except during specified periods in zones in the eastern and central Aleutians, and whaling along Alaska's coast except in a portion of the Gulf of Alaska (fig. 8). The Japanese were permitted to conduct salmon fishing operations in the contiguous zone off the Aleutian Islands west of long. 175° W. (provisional line specified in the International North Pacific Fisheries Convention). They agreed to conduct their salmon operations with due regard to the conditions of the runs of salmon of Alaskan origin.

Japan was also granted authorization to conduct loading and support operations within the contiguous zone in two areas in the Gulf of Alaska: (1) off Kayak Island, and (2) off Sanak Island. Except for Alaska, no recognition was given to continued Japanese fishing inside the U. S. 3- to 12-mile fishery zone of the contiguous 48 States of the U. S. and Hawaii.

The agreement also provided that Japan refrain from fishing during the first 15 days of the U. S. halibut season in the two zones off Kodiak described in the Soviet agreement. Further, Japan agreed not to fish from September through February in: (1) the six crab pot zones surrounding Kodiak Island, the boundaries of which are identical to those established by the 1964 U. S.-USSR agreement, and (2) a zone south of Unimak Island and the eastern Fox Islands used extensively by the U. S. king crab pot fishermen. Prior to the agreement's expiration, the parties are to review it and discuss possible arrangements for continued Japanese fishing.

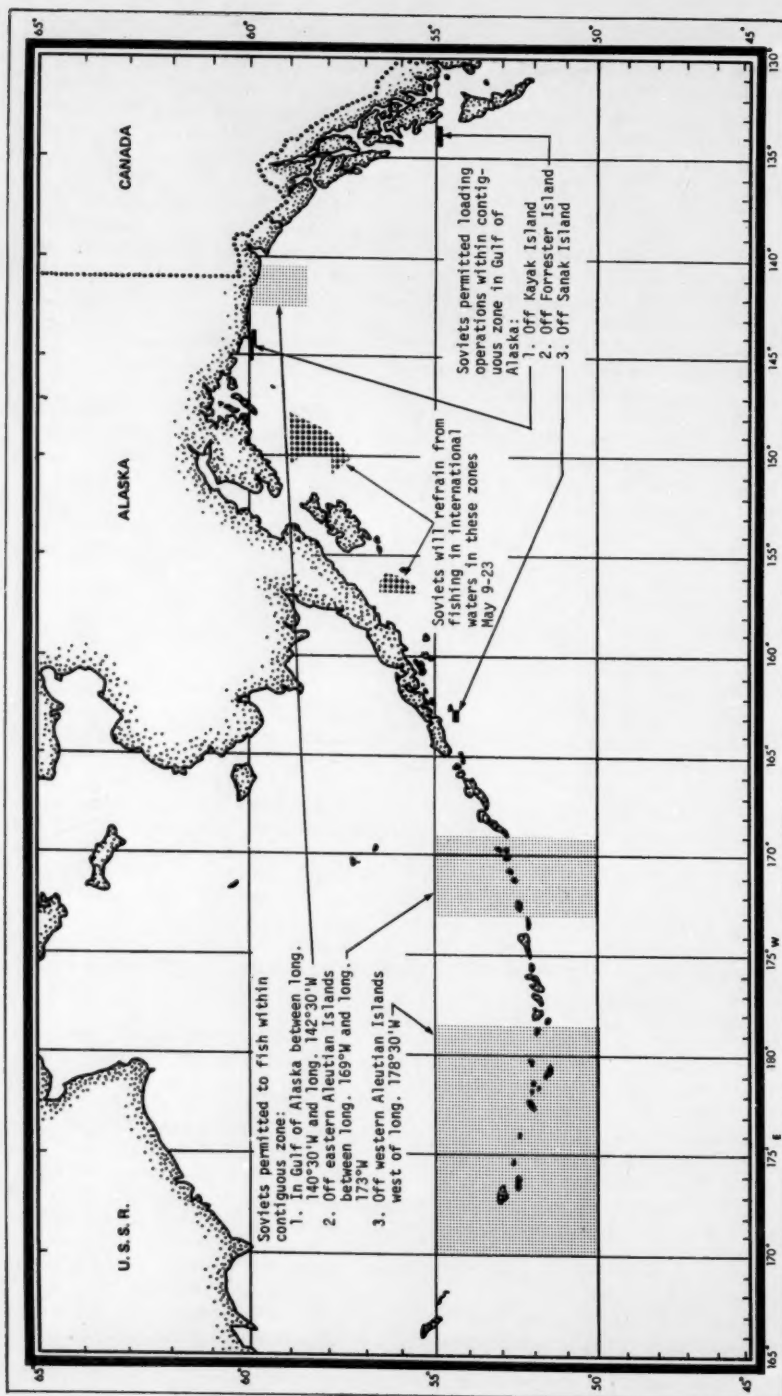


Fig. 7 - Fishing and loading areas established by 1967 U.S.-USSR contiguous fishery zone agreement.

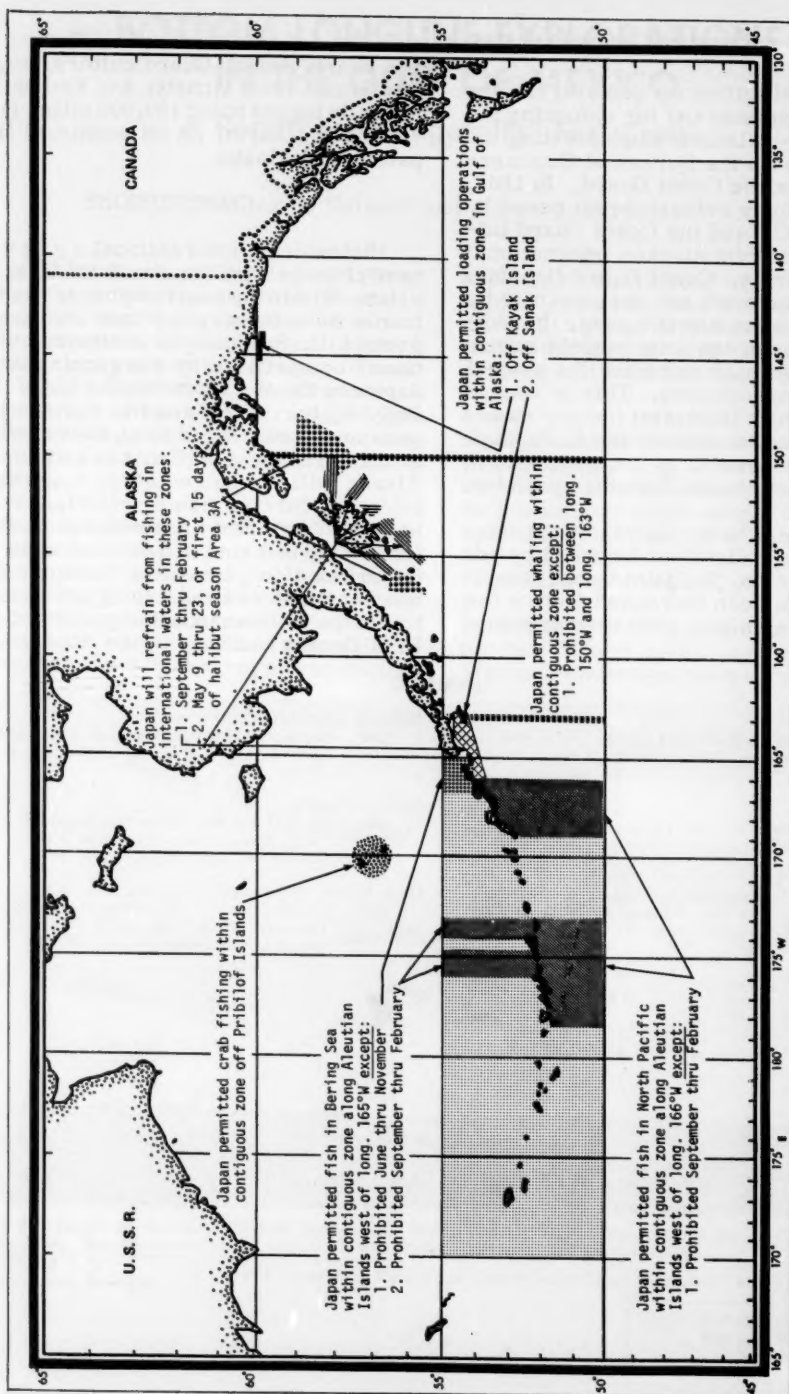


Fig. 8 - Fishing and loading areas established by 1967 U. S. - Japan contiguous fishery zone agreement.



## POLICING OF FISHERIES AGREEMENTS

U. S. responsibilities for policing the international agreements and for enforcing the U. S. laws and regulations implementing the agreements lie with the Bureau of Commercial Fisheries and the Coast Guard. In 1960, with the increasingly evident threat posed by foreign fleets, BCF and the Coast Guard initiated a system of joint Alaskan international fisheries patrols. Coast Guard fisheries patrol ships and aircraft are accompanied by BCF fisheries enforcement agents. In addition to enforcement, the joint patrols gather information on foreign fisheries not subject to international agreements. This is done to help determine their impact on fishery stocks of current or potential value to the U. S. Such information is essential to formulate U. S. national and international fisheries policies.

To keep pace with the increasing foreign fisheries and the obligations imposed by additional agreements, the joint Coast Guard-BCF patrols have been increased from a few weeks by a single ship in 1960 to year-round

surface and aerial patrols. During the past few years, Coast Guard cutters, augmented by aircraft from Annette and Kodiak Islands, annually logged about 250,000 miles (10 times around the earth) on international fisheries patrols off Alaska.

## CONCLUSIONS

Historically, international agreements have played a significant role in Alaskan fisheries. Within the past few years, such agreements have been relied upon increasingly to protect U. S. fisheries confronted with continual competition by burgeoning Soviet and Japanese fleets. As the world turns increasingly to the living marine resources of the seas as a source of food, the fishery resources on the vast Continental Shelf off Alaska will be subjected to more and more intensive foreign fishing efforts. There can be little doubt that bilateral and multilateral fishery agreements will assume even greater importance in preventing foreign encroachment on the stocks and fishing grounds essential to the maintenance and growth of a viable U. S. fishing industry in the Alaska area.

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# BOTTOM LONGLINE EXPLORATIONS IN THE GULF OF MEXICO

## A Report on "Oregon II's" First Cruise

By Walter R. Nelson\* and James S. Carpenter\*\*

The BCF Exploratory Fishing and Gear Research Base at Pascagoula, Miss., has been concerned with improving the harvest and harvesting methods of the snapper industry and locating stocks of bottomfish not now used as food. In 1960, Captiva and Rivers reported on the practical use of roller-rigged fish trawls for catching snappers and groupers, but this method has not yet been accepted by the industry.

Recent emphasis has been placed on bottomfish explorations with longline gear along the edge of the Continental Shelf and upper Continental Slope, an area that has received only token coverage. Shrimp and snapper explorations have been confined generally to depths less than 50 fathoms; royal-red shrimp

explorations have been carried out mainly in depths greater than 200 fathoms. Limited sampling has been done in the 50- to 200-fathom depth range with shrimp trawls, which are not efficient for catching large mobile fish.

Segments (Trips 3 and 7) of Cruise 1 of the R/V Oregon II (fig. 1) were designed to add knowledge of bottomfish stocks within the 50- to 200-fathom depth range, to determine the availability of deepwater bottomfish to longline gear, and to evaluate the commercial feasibility of this gear.

These trips were concerned with exploring for new fishery resources in the Gulf of Mexico. Coverage, not maximum production,

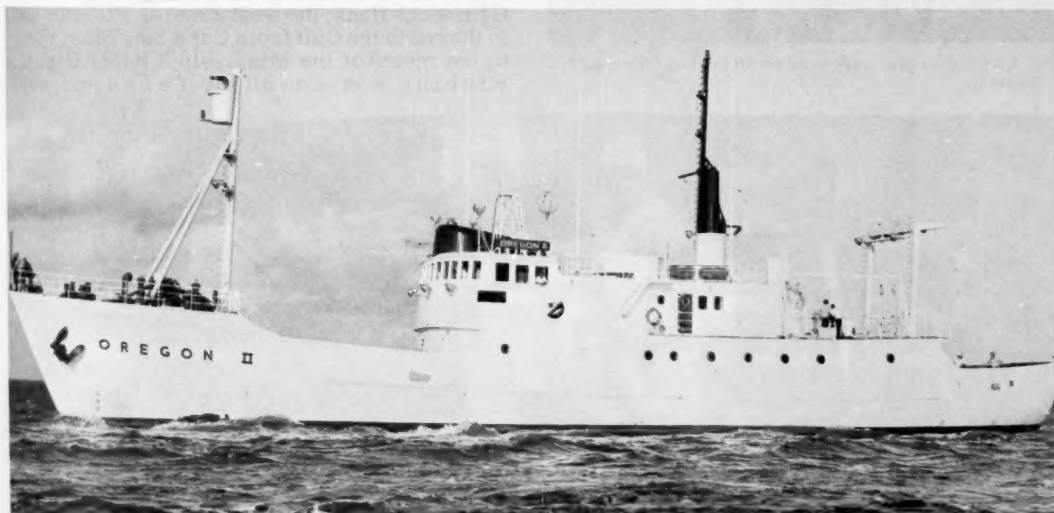


Fig. 1 - The R/V Oregon II, the new, 170-foot, multipurpose fishing vessel of BCF's Exploratory Fishing and Gear Research Base at Pascagoula, Miss. She will conduct exploratory work in the Gulf, Caribbean, and South Atlantic.

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was emphasized. The catch rates would have been higher had we sampled intensively those areas where large catches were made. Also, the gear used was a rather small sampling unit designed for a rapid survey.

### GEAR

The bottom longline or "trawl" consisted of three 100-hook baskets of gear shackled together. One basket each of sizes 6, 7, and 9 circle hooks baited with squid or ladyfish was fished at each station. Hooks on

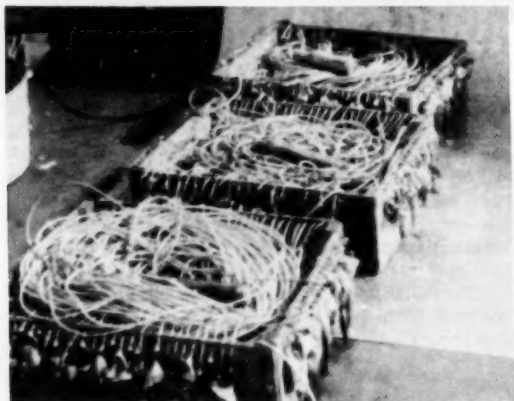


Fig. 2 - Longline gear ready to be set off the stern of the R/V Oregon II.

6- to 12-inch monofilament gangions were attached at 10-foot intervals to a  $\frac{1}{4}$ -inch polydactylene or nylon mainline. The line was coiled in shallow wooden notched boxes and set off the stern (fig. 2). Fishing time varied from 1 to 2 hours. The gear was retrieved with a Japanese longline hauler designed for tuna and swordfish longlines. The short gangions and circle hooks went through the roller and hauler easily, so the fishermen had to handle the line only when removing fish (fig. 3). Including running time between stations, as many as 8 gear sets were made within a 24-hour period.

The only sizable losses of gear occurred when sets were made on snapper lumps. There, hangups were frequent. Jarvis, in 1935, and Whiteleather and Brown, in 1945, reported large gear losses from bottom longline sets made on rough bottom in the Gulf and Caribbean. Most of the Oregon II sets, however, were made off coral areas and little fouling took place. Overall, only about 2 percent of the total hooks fished were lost.

### AREA FISHED

Exploratory fishing was conducted off Texas and Louisiana, the northern edge of the Campeche Bank, the west coast of Florida and in the northern Gulf from Cape San Blas, Fla., to the mouth of the Mississippi River (fig. 4). Fishing was done off the Texas and west



Fig. 3 - Removing small fish from longline. Short gangions went through the roller (on the rail) and longline hauler (right) without fouling.

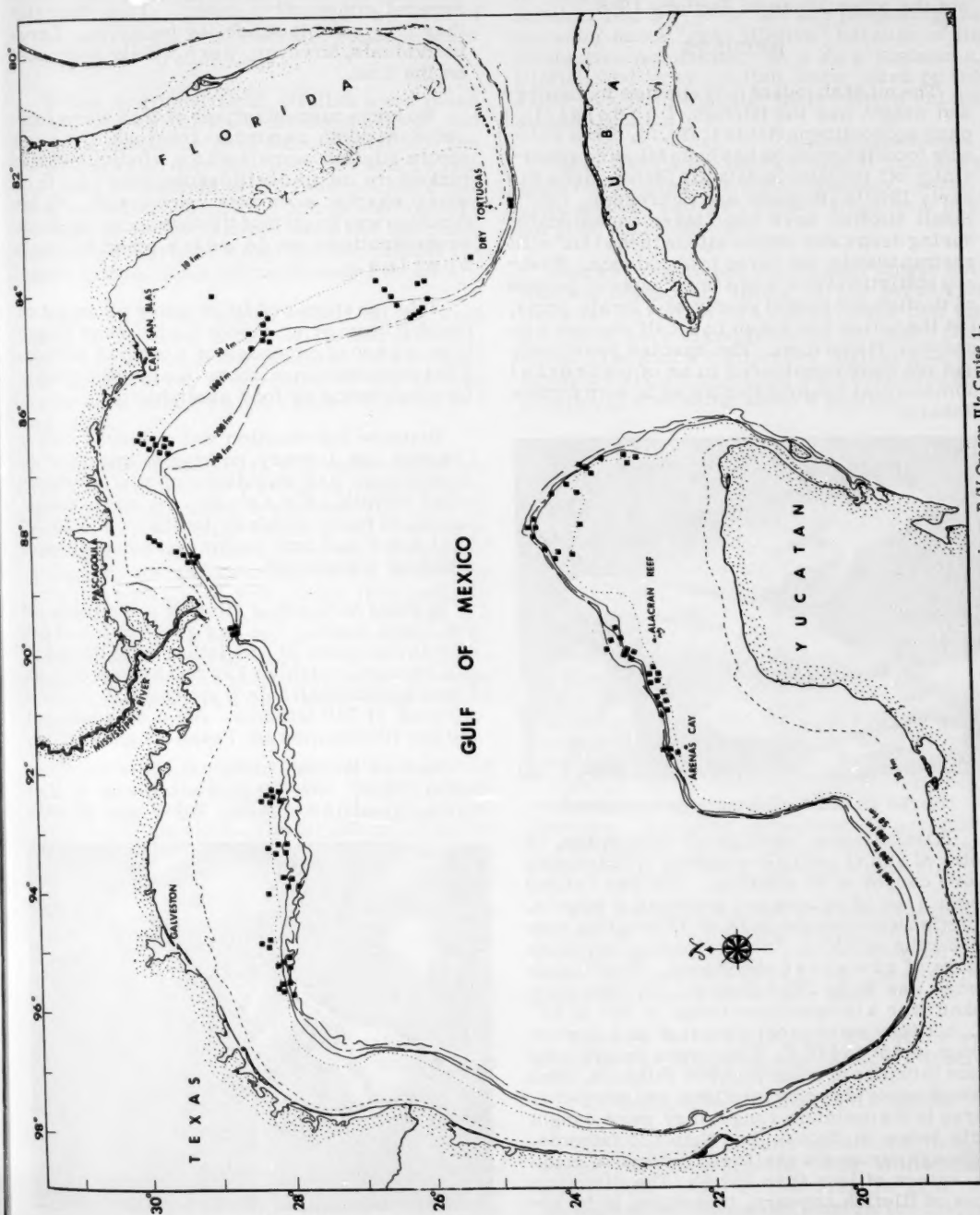


Fig. 4 - Bottom longline sets made on R/V Oregon II's Cruise 1.

Louisiana coasts in October 1967 and throughout the other areas in January 1968.

### RESULTS

The most abundant food species by number and weight was the tilefish, *Lopholatilus chamaeleonticeps* (table 1, fig. 5). This valuable foodfish species has been taken commercially off the Middle Atlantic States since the early 1900's (Bigelow and Schroeder, 1953). Small tilefish have been taken occasionally during deepwater explorations in the Gulf with shrimp trawls, but never in abundance. Fishery statistics show that a few thousand pounds of tilefish are landed yearly at Florida ports, but these fish are taken in small numbers by snapper fishermen. The species previously had not been considered to be of potential commercial importance as a separate fishery.

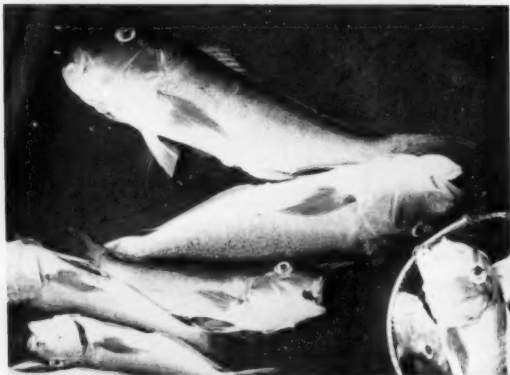


Fig. 5 - The tilefish, *Lopholatilus chamaeleonticeps*.

Tilefish were taken in all Gulf areas. A total of 285 tilefish weighing 1,695 pounds were caught at 48 stations. The fish ranged from 1 to 27 pounds and averaged 6 pounds. Tilefish were caught on 28 of 39 longline sets in depths of 150 to 200 fathoms, the depth range of greatest abundance. Total depth range was 90 to 225 fathoms. Tilefish were taken over a temperature range of 50° to 63° F., but they were most abundant in a narrow range of 55° to 57° F. They were caught only once in depths greater than 200 fathoms, even though several deeper stations had temperatures in the optimum range; they were caught only twice at depths less than 125 fathoms, although numerous shallower sets were made in waters of less than 63° F. The distribution of tilefish appears, therefore, to be affected by both depth and temperature.

Small tilefish were taken occasionally on several consecutive hooks. This indicated they may exhibit schooling behavior. Large individuals, however, were widely separated on the line.

No large concentrations of fish were indicated on depth recorder tracings in areas where tilefish were taken. Individual fish picked up on an oscilloscope proved to be small sharks when sets were made. No indication was found that tilefish occur in dense concentrations as do some other bottom species.

Tilefish appeared to be more abundant on rough bottom or on moderate to steep slopes than on broad expanses of smooth bottom. This phenomenon might be due to either habitat preference or food availability.

Because information was gathered only in October and January, nothing is known of the distribution and abundance of tilefish during other months. However, the environment should be fairly stable at depths of 150 to 200 fathoms and any major seasonal changes would be unexpected.

Highest catches of tilefish were made off the Texas coast. The largest catch of 285 pounds was made at 150 fathoms, followed by a 217-pound catch at 190 fathoms (fig. 6). Average catches (table 2) approached  $\frac{1}{2}$  pound per hook at 200 fathoms. All 6 sets between 150 and 200 fathoms off Texas caught tilefish.

Next in tilefish abundance was the Campeche Bank. The largest catch was 12 tilefish weighing 166 pounds. All 8 sets at about



Fig. 6 - Tilefish taken on one 300-hook set off Texas.



150 fathoms took tilefish. Few tilefish were taken east of Alacran Reef, but the catch averaged  $23\frac{1}{2}$  pounds per 100 hooks west of Alacran Reef. The heaviest concentration was north of Arenas Cay.

In the northern Gulf, tilefish were taken off the mouth of the Mississippi River and along the eastern edge of DeSoto Canyon. The largest catch per 300-hook set was 14 fish weighing 104 pounds at 175 fathoms, the depth of greatest abundance. Central and western portions of DeSoto Canyon were not sampled, but it is quite probable that tilefish inhabit the entire canyon area off northwest Florida.

Only 3 tilefish were caught off the west coast of Florida, from 125 to 225 fathoms. The catch, although low, at least showed tilefish in the area. Concentrated stocks may have been missed because of limited sampling.

The other foodfish found in some abundance was the yellowedge grouper, Epinephelus flavolimbatus, which accounted for over 50 percent of the total weight of all species of groupers. In contrast to most species of groupers, the yellowedge was not limited to rough terrain. It was caught frequently in areas of flat smooth bottom. A total of 113 fish weighing 1,168 pounds was taken at 21 stations over a depth range of 70 to 150 fathoms. The fish were relatively large; average weight was 10 pounds, size range 4 to 20 pounds.

Yellowedge grouper were abundant in only 2 Gulf areas. Highest catches were made off Texas--one set at 100 fathoms yielded 24 fish weighing 271 pounds. The largest catch on the Campeche Bank was a 105-pound catch made on the northwestern edge. Only 3 yellowedge groupers were caught in the northern Gulf, and none was taken from the west coast of Florida.

The warsaw grouper, E. nigritus, was next in importance to the yellowedge grouper off Texas and on Campeche Bank. At depths of 100 to 125 fathoms, the average catch per 100 hooks for the 2 areas was 10 pounds and 12 pounds, respectively.

Moderate numbers of the gray tilefish, Caulolatilus microps, were taken on east Campeche Bank from 75 to 125 fathoms. The largest catch was 125 pounds at 125 fathoms. Average size was 6 pounds and size range

was 1 to 15 pounds. This species is not listed in American Fisheries Society Special Publication No. 2 (1960). We are proposing the common name "gray tilefish" because of its distinctive coloration. In a few instances, tilefish and gray tilefish were taken on the same set, but generally their ranges did not overlap.

Other foodfishes taken in small quantities were red snapper, vermilion snapper, wenchman, scamp, red grouper, black grouper, porgies, and Gulf hake.

Sharks constituted the largest single bottomfish component (table 1)--32 percent of the total bottomfish catch. Over half the sharks were taken from the northern Gulf area. The catch comprised dogfish sharks, Squalus and Centrophorus, and smoothhounds, Mustelus, averaging about 4 pounds.

Off the Texas coast where catch rates were highest, foodfish constituted 77 percent of the total catch; they accounted for about one-half of the total foodfish catch for all Gulf areas, although only about one-fourth the total effort was expended off Texas (table 1). Peaks in foodfish abundance off Texas were found at about 100 and 200 fathoms (table 2). Several species of groupers (mostly yellowedge grouper) were predominant in the 100- to 125-fathom depth range. They were replaced by tilefish in deeper waters.

On the Campeche Bank, the second most productive foodfish area, most foodfish were taken west of Alacran Reef. As occurred off Texas, groupers dominated shallower areas, and were replaced by tilefish beyond 125 fathoms. Foodfish constituted 74 percent of the total catch, but they were relatively abundant only around 125 fathoms (table 2).

The north Gulf catch was comprised primarily of sharks; the tilefish was the only foodfish taken in any abundance (table 1). The other foodfish category, for the most part (table 2), consisted of Gulf hake.

Catches were extremely low off the west coast of Florida for all depths and all species.

#### COMMERCIAL CONSIDERATIONS

Our longlining results agree with those of earlier workers (Jarvis, 1935; Whiteleather and Brown, 1945) in that longline gear does not appear commercially feasible for catching

snappers, but it may have some application for groupers. A number of sets were made on rough bottom within the depth range inhabited by red snapper, *Lutjanus campechanus*, and silk snapper, *Lutjanus vivanus*. However, only 1 silk snapper and 65 red snappers were caught during the entire cruise. Grouper catches were higher, but these approached possible commercial concentrations only off Texas in about 100 fathoms.

The apparent absence of dense schooling behavior in large tilefish makes it unlikely that they would support a handline fishery. A longline covers a relatively larger area of bottom than do handlines. It should provide higher catch rates per unit of effort. Our catch rates made in areas of greatest concentration off Texas compare favorably with an early report on longline catches of 30 to 40 tilefish per 400 to 500 hooks off the Middle Atlantic States (Bumpus, 1899).

The Texas coast is the only part of the Gulf that appears to offer commercial potential with longlines. Certainly a large number of hooks would have to be fished. Projections of catch rates presented in this paper indicate that a daily fishing effort of 5,000 hooks should result in average daily catches of about 2,000 to 4,000 pounds of tilefish.

We conclude from the results of Cruise 1 of the R/V Oregon II that the bottom longline is more valuable as a tool for locating and assessing bottomfish stocks than as a method of commercial harvesting by present-day standards.

A trawling potential appears likely throughout the Gulf where the bottom is not excessively rough. Tilefish are taken commercially with trawls in the Middle Atlantic States, so they should be susceptible to trawling in the Gulf. In most areas where tilefish were taken, the bottom was rough or sloping, but little recorded bottom was unsuitable to the use of roller-rigged fish trawls. Certainly a tilefish potential exists. Future deep-water fish trawling cruises in the Gulf by the R/V Oregon II are scheduled to determine the feasibility of a trawl fishery for this foodfish.

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A detailed fishing log (table 3) showing geographic position, depth, date, catch and related data for each set is available as an appendix to the reprint (Sep. No. 826) of this article. Tables 1 and 2 are also in the reprint. For a free copy of the Separate, write to Branch of Reports, Publications Unit, BCF, 1801 N. Moore St., Arlington, Va. 22209.

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# INTERNATIONAL

## ICNAF Holds 1968 Annual Meeting in London

The International Commission for the Northwest Atlantic Fisheries (ICNAF), which held its annual meeting in London, June 4-8, reported that the catch of traditional fish species in the Northwest Atlantic increased by about 4 percent--to 3,331,000 metric tons--from 1966 to 1967. Increases were noticeable particularly in the Greenland, Labrador, and Newfoundland areas. There was a decrease in catch of cod, haddock, and flatfish in the Gulf of St. Lawrence, Nova Scotia Banks, and Gulf of Maine areas.

### Intensity of Fishing

Scientific assessments of the major exploited fish stocks indicate that in the Greenland-area cod and Georges Bank-haddock fisheries, intensity of fishing has reached, and may have exceeded, levels giving the largest sustainable catches. The same, or higher, average catch could be achieved with less intensity at considerably less cost.

Several delegations consider that high-seas fishing for Atlantic salmon either should be prohibited or stabilized at present level.

### New Proposal for Regulation

The Commission examined a proposal to add economic and technical considerations to the present scientific investigations--on which proposals for new regulatory measures are based. Member governments have been invited to consider the proposal for further discussion at the 1969 annual meeting.

A joint U. S.-USSR survey of the Georges Bank-Gulf of Maine area is providing important information on research techniques and gear to be used in studies of year-to-year abundance of haddock stocks.

### Otter Trawl Gear Size

The minimum mesh size in otter-trawl gear became an effective international regulatory measure for major commercial species throughout the Northwest Atlantic area on Sept. 24.

The 1969 meeting will be held in Warsaw, June 2-7. The Commission accepted an invitation from Canada to hold its 1970 meeting in St. John's, Newfoundland.



## Indo-Norwegian Project Spurs Investment in Fishing

The Indo-Norwegian Project (INP) begun in 1952 is a comprehensive program designed to develop deep-sea fishing in India. Its aims are to improve offshore fishing techniques, fish processing and curing techniques, construct ice plants and fish freezing and storage facilities, establish boatbuilding yards, and train fishermen.

Norway supplies machinery and equipment, including technical personnel, for local operation of project facilities and training, both in India and abroad.

India provides sites and utilities for projects, construction and building materials, labor, technical and administrative personnel, and pays rupee costs of Norwegian personnel. The project has been expanded to include exploratory and hydrographic surveys of fishing grounds.

### Discover New Shrimp Resource

INP vessels have found major new shrimp grounds at 900 to 1,200 feet about 1,000 square miles off Quilon coast of Kerala. Fishing has yielded 1,760 lbs./hr. of large shrimp. The new grounds could revolutionize the local industry.

### Plans for Indian-Built Trawlers

INP is offering local shipyards designs for the 70- to 90-foot-long steel-hulled vessels needed to trawl at 1,200 feet. The government insists that a third or more of all trawlers must be built in India, although cost of locally made hulls is about 50 percent higher than European-built vessels.

Giovanola Binny Ltd., Kerala, has decided tentatively to begin construction of large

steel-hulled trawlers. The firm expects to quote prices comparable to those of imported vessels. Binny estimates the demand for such trawlers will expand as local firms learn the advantages of exploiting sea resources with larger mechanized craft.

#### Other Activities

Preliminary INP surveys indicate that shrimp fishing off the eastern coast of India should be as good as off Kerala coast. In Madras State, INP is presently erecting a boat-building yard for small motorized craft, a 50-ton-a-day fish-meal plant, a 100-ton fish-freezing plant, and a training and servicing center for fishermen. INP also is scheduled to survey fishing prospects off Madras. (U. S. Consul, Madras, June 26.)



### FPC Market Survey Set for Chile and S. Korea

The Agency for International Development (AID) has awarded its first contract for studies of the commercial marketing potential of fish protein concentrate (FPC). Under a \$268,073 contract General Oceanology, Inc., of Cambridge, Mass., will conduct feasibility studies in Chile and South Korea over the next year.

#### AID Donations of FPC

Dr. H. Brooks James, AID assistant administrator for the War on Hunger, described the study as an important step toward introduction of relatively low-cost, high nutrition, foods in developing countries.

In April, AID contracted with Alpine Marine Protein Industries, Inc., of New Bedford, Mass., to produce FPC for use in AID-administered Food for Freedom donation programs in developing countries.

#### Survey Aims

General Oceanology will determine whether the market potential for FPC in Chile and South Korea justifies commercial development. These countries were selected because of their relatively advanced fisheries. The survey will analyze such factors as consumer and market characteristics, acceptability of

FPC-fortified foods, and production costs in relation to the market. Results are expected to provide a basis for planning the development of FPC industries by private industry and Chile and S. Korea.



### U. S. Helps Thailand Develop Fish Protein Supplements

The Agency for International Development (AID) is studying a project to improve nutrition in rural areas of Thailand. The project also will develop inexpensive high protein food supplements, especially for preschool children in the northeastern regions. Called "Protein Food Development," the project will run from 1969 to 1971. The U. S. has committed \$225,000. Thailand will contribute \$325,000: \$175,000 in counterpart funds and \$150,000 in cash.

#### Protein Deficiency in Northeast

Thailand is a major rice producer and generally has a favorable food supply. But large areas, particularly the northeast, are protein deficient. Children 1 to 4 years are hardest hit by this deficiency. Up to 50% of preschool children in northeastern and northern rural areas suffer from protein and caloric malnutrition.

#### Marine Fish Provide Protein

In developing the supplements from local protein foods, emphasis will be placed on marine fish, one of the Thai foods best suited for the purpose. From 1960 to 1967, Thailand's annual marine fish catch increased from 250,000 metric tons to nearly 600,000 tons. Improved fishing methods could double the catch.

Protein necessary to offset nutritional deficits for 1.6 million children could be supplied from only 265,000 tons of fresh marine fish, or 16,000 tons of dried fish. This would be less than 5% of the present annual catch and considerably less than the tonnage increase each year. Poor marketing and distribution keep processed and fresh marine fish from reaching protein-deficient provinces. Only areas near the main railroad centers have a constant, reasonably priced, supply of marine products.



## Distribution A Problem

Supplying fresh-water fish is not a solution. The fresh-water catch is only about 100,000 tons per year and the wholesale price is more than twice that of marine fish. Although it is mainly a question of supply and demand, the result is that those in the North and Northeast must pay twice as much for fish protein as those living in the southern and coastal areas. It is significant that the incidence of protein malnutrition in the northeastern provinces correlates roughly with the availability and cost of fishery products. The AID project should help insure better distribution. (U.S. Embassy, Bangkok, July 24.)



## European-Caught Fish Transshipped from St. Pierre & Miquelon Islands

The French islands of St. Pierre and Miquelon, 12 miles off Newfoundland, have begun major transshipments of European-caught fish. Transshipments are forbidden in Canadian ports.

Transshipment from St. Pierre nullifies much of Canada's advantage in being close to the rich Grand Banks fishing grounds. European deep-sea trawlers will be able to fish almost as steadily as Canadian-based vessels. These European vessels no longer are forced to return across the Atlantic or head south for the big U. S. fish market once their holds are full. They can put into St. Pierre and transfer fish directly to waiting freighters--or stockpile them for later pickup. After stocking up with food and fuel, the trawlers can return to fishing. Within the last 2 years, St. Pierre has become a nearly complete marine service station for big trawler fleets fishing the Grand Banks. Transshipment was practiced here before--but never on the present large scale.

### Large Investment

This bolstering of the marine cornerstone of St. Pierre's economy, aided by France's Common Market partners, has involved much money.

Common market money also has helped to build a waterfront marine sciences laboratory

to serve European fishing interests. It will employ 16 French scientists.

### W. German & Spanish Fleets

West German and Spanish fishing fleets have set up complete operational bases. Such bases were common in St. John's until recently, but they are becoming rare sights in Newfoundland ports.

The Spaniards apparently plan no major transshipments from St. Pierre. They have established a fully equipped supply base to fill food and fuel needs of their Grand Banks fleet.

The West Germans transfer frozen fish blocks directly from trawlers to freighters in St. Pierre's harbor. In one month, over 40,000 barrels of West German-caught pickled herring were stockpiled on the waterfront to await transshipment home.



## FAO Caribbean Project Issues First-Half 1968 Report

During Feb.-June 1968, the "Alcyon," one of the 3 vessels connected with the UNDP/FAO Caribbean Fisheries Development Project, completed wide-ranging exploration and experimental fishing of demersal fish in the northern part of the Project area. Two of the 4 cruises completed were designed to improve fishing techniques. The planners hoped these would provide catches which might increase West Indian use of the resources. The Alcyon fished independently and also acted as "mothership" or base for up to 3 small boats.

### Earlier Cruises

Earlier cruises had explored waters southwest of Jamaica, northeast of Hispaniola, and east of Puerto Rico. During a February cruise, exploratory snapper fishing was carried out on the western edge of Pedro Bank, Rosalind Bank and along edge of the Continental Shelf east of Nicaragua. The primary aim was coverage and familiarization with the grounds. Over 10,000 pounds of fish were caught in operations divided between day and night fishing. Almost 60 percent of the catch was snapper (chiefly silk, blackfin, black, and yellowtail) and much of the remainder was jacks (Carangidae).



A March-April cruise extended exploratory fishing for snapper and related species along the northeast coast of Hispaniola and in waters adjacent to the Virgin and Northern Leeward Islands. Over 20,000 pounds of fish, mostly snapper, were taken. Fishing was excellent near Monti Cristi and Navidad Banks north of Dominican Republic, near Sombrero Cay, and on Anguilla and Barracuda Banks east of the Virgin Islands.

#### Southwest of Jamaica

In May and June, 2 cruises were made with auxiliary small craft operating from the mothership Alcyon. One cruise used one dory and one local-style (Jamaica) canoe. After 12 days fishing southwest of Jamaica, from Alice Shoal to edge of Central American Continental Shelf (about 14°30' N.) 23,398 pounds of fish were recorded aboard the Alcyon. Highest catch for a 24-hour period was 5,281 pounds. Over 60 percent of the catch was taken by fishing from Alcyon, the remainder by the small boats. Principal species were horse-eye jack and mutton snapper, averaging 10-14 pounds each.

On the other cruise, a second dory was added. Six days of hand-lining and incidental trolling produced 5,085 fish weighing 18,042 lbs. The Alcyon and one dory manned by crew members and a trainee caught 2,779 fish weighing 10,211 lbs. The other dory, manned by 2 Manchioneal (Jamaican) fishermen, caught 961 fish weighing 3,459 lbs.; the canoe with 2 Port Royal fishermen took 1,345 fish weighing 4,393 lbs. The boats manned by local fishermen were equipped with one hand-operated reel (Norwegian type) and conventional hand-line gear.

#### The Catch

The 4,927 fish (17,326 lbs.) caught by mechanical reels and handlines were, by weight, 89.1 percent jacks, 5.1 percent snapper, and 5.8 percent other fish, such as grunts, groupers, triggerfishes. Prominent species of jacks were green jack, 35.8 percent by weight, and horse-eye jack, 53.4 percent, with a trace of amber jack, almaco jack, and bluntnose jack.

Much fishing was done with mechanical hand reels, equipped with 160 fathoms of wire, and capable of fishing to 140-150 fathoms. Silk (yellow-eye) snapper were taken from greater depths (90-140 fathoms) than

other snapper species; blackfin snapper ranged between silk and black snapper (about 40-80 fathoms). The heavy catches of jacks were in 24-30 fathoms, using both reels and hand lines. Squid was the primary bait used. (UNDP/FAO Caribbean Fishery Department Project, July 19.)



#### Soviets Seize 4 Norwegian Vessels

Two Norwegian vessels seining for herring in the Barents Sea were seized by Soviet fishery patrol vessels on July 16. Soviet authorities reported to Norwegian Border Commissioner A. Rygg the seizure of "Onny Harder" of Baatsfjord inside Soviet territorial waters at 70°3'30" N., 31°47' E. "Egil" of Vadsø was seized the same day.

#### Fined and Released

The 2 vessels have been released. Fines were 110,000 kroner (US\$15,416). The vessels also had to surrender their nets. Norwegian authorities say the vessels were in Soviet territorial waters; "only the nets," say the owners.

#### Holding 2 Other Vessels

A third Norwegian fishing vessel seized in early July was not released as of mid-August. The fourth vessel was seized on August 5. Soviet officials told the Border Commissioner to maintain tighter control over the herring fleet or face more severe action in the future. Rygg has asked the North Norway Naval Command to police Norwegian vessels fishing near the Soviet 12-mile limit. The Navy replied that it "does not intend to station any . . . vessels permanently in those waters." ("Arbeiderbladet," Aug. 8; U. S. Embassy, Oslo, Aug. 15.)



#### USSR Seizes Japanese Vessels

Two Japanese herring vessels carrying 38 crewmen were seized by Soviet patrols on May 16 for violating Soviet territorial waters. Thirty-four crewmen were released; the two captains were still being detained at the end of July. The released crewmen were not allowed to return to Japan until August 3.

Five vessels with 33 men were seized off the Soviet Pacific coast on June 1. Tried on July 31 and fined 1.04 million yen (US\$2,888), they were still being held incommunicado aboard their vessels in Nakhodka on August 4.

#### 18 Vessels Seized

According to the Nemuro Maritime Safety Office, the Soviets seized 18 vessels and 131 fishermen between January 1 and July 18. Only 5 vessels and 94 fishermen had been released by July 26. In previous years, even more vessels and men had been detained. Twenty-eight of those fishermen and an unknown number of vessels were still in Soviet custody.

On July 27, a 2-man Hokkaido-based fishing boat was seized off Etorofu (Iturup), the southernmost Kuril Island, for alleged violation of Soviet territorial waters.

Seizures are likely to continue because no peace treaty has been signed and Japan recognizes neither Soviet sovereignty nor 12-mile fishing limits in the southern Kurils. ("Suisan Keizai," July 26.)



### High-Seas Salmon Fishing Off Norway Is Good

About 20 Danish and 7 Swedish long-line vessels fished for Atlantic salmon off the west coast of Norway during May. Catches were good, though crews had to work nearly round the clock. The flesh color of the salmon was excellent, but the fish were lean and of much lower quality than Baltic salmon.

#### Transportation Difficulties

Danish and Swedish fishermen are not permitted to land catch in Norway for transshipment. They must either make the long trip home or pay others to transport their catch. Skippers have found they must allow 3 weeks for the round trip. Sailing time is only 2 weeks, but the crew insists on a week at home. Therefore, skippers prefer to remain on the fishing grounds and ship catches on other vessels. Freight costs amount to about one-third the price paid for the catch in home ports. This makes fishing less profitable.

### Norwegian Opposition

Norway opposes high-seas salmon fishing and was planning to discuss with Denmark and Sweden an end to the fishery. (Asst. Regional Fisheries Attaché, U. S. Embassy, Copenhagen, July 5.)



### Seminar on Marine Radioecology in December

A seminar on Marine Radioecology sponsored by the European Nuclear Energy Agency and the French Commissariat à l'Energie Atomique will be held Dec. 3-6, 1968, at Cherbourg, France. Particular attention will be given to practical aspects of research in marine radioecology relevant to waste disposal operations. (USOEC, Paris, July 9.)



### Spain Delivers Vessel to Cuba

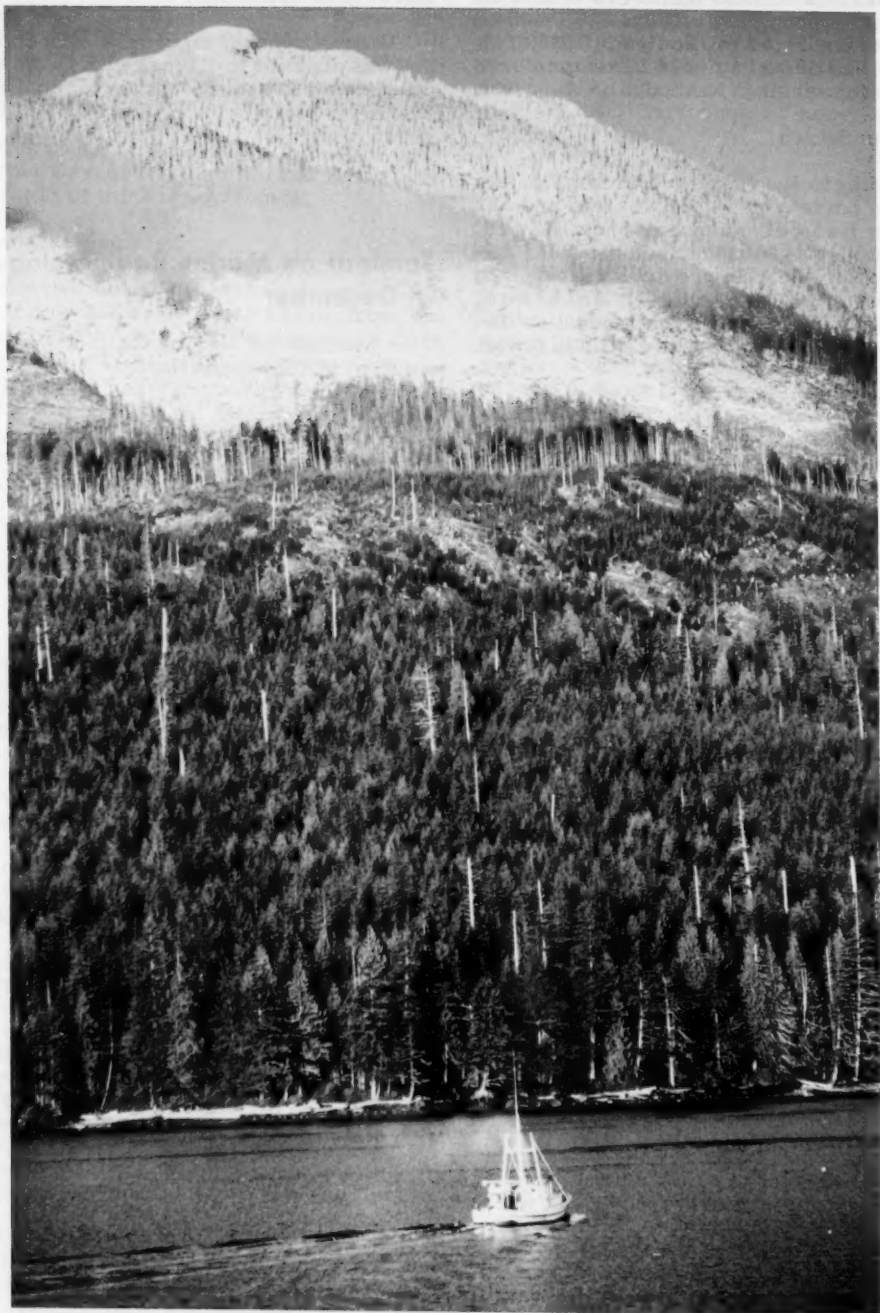
The first of 6 fishing vessels built for Cuba by Empresa Naval Espanola Santander was delivered on September 15. The 6 vessels, first of 14 to be built by this shipyard, are part of the 90 Cuba has ordered from Spain.



### Japanese Seek Consulate in Alaska

The Japan Fisheries Society has asked the Government to establish a consular office in Kodiak, Alaska, because of the rapidly growing trade between Japan and Alaska. In the 9 years of Alaska's statehood, trade with Japan in fishery products, lumber, and petroleum has increased to over US\$115 million a year. The Society wants consular services to improve and expand trade relations, and to handle problems arising from Japanese vessel operations off Alaska. ("Suisan Nippo," Aug. 22.)





Gill netter on Johnstone Strait, British Columbia. Vancouver Island in background. (Photo: F. Bruce Sanford)

# FOREIGN

## CANADA

### ASSISTS INDIAN FISHERMEN

The Canadian government has established a C\$4.5 million Indian Fishermen's Assistance Program in British Columbia. The 5-year program will be administered by 5-man "Indian Fishermen's Development Board." Funds will be provided by the Department of Indian Affairs, but the Federal Department of Fisheries will administer the program.

#### Newer Equipment & Training Courses

Loans and grants will be provided to acquire newer, more efficient, vessels and fishing gear and to reconstruct or convert old vessels. Construction of marine railways, vessel repair centers, gear sheds, and dry-boat storage facilities at selected villages will help the Indians improve the repair and maintenance of vessels and gear. Training courses will be offered to increase efficiency in fishing enterprises.

#### Training Courses Underway

Fisheries training courses under this program already have begun. In the 1967/68 winter season, Indian Affairs Branch sponsored 28 courses. Special instruction in navigation, electronics, engine repair, fishing gear, vessel design, and maintenance was provided for about 400 Indians at 14 villages.

Two marine railways were slated to be constructed during the summer at the villages of Cape Mudge and Kitkatla. These installations, costing about \$84,000, will initiate the improvement of Indian fishermen's shore facilities. (Canadian Dept. of Indian Affairs and Northern Development, July 9.)

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#### AGREEMENT REACHED ON FLOOR-PRICE PLAN

The Canadian government will support groundfish prices in the Atlantic provinces. Payment will be made to processors who will pay higher prices to fishermen. Neither fishermen nor processors like the plan. They agreed to this method of payment primarily

because it reduces the danger of countervailing duties by the U. S. to more obvious government assistance. (U. S. Consul, St. John's, June 13-14.)

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### GRANTS FISHERIES DEVELOPMENT LOAN TO TRINIDAD AND TOBAGO

The Secretary of State for External Affairs announced June 14 that Canada will extend C\$3,000,000 in External Aid development loan funds for 5 projects in Trinidad and Tobago. C\$250,000 has been allocated for a fisheries development project. The loan will pay for an advisor on biological fisheries research, Canadian training for research and biological station officials, a trawler, two refrigerated trucks, and technical assistance, including a skipper and an engineer to train a crew for the trawler. All equipment and goods are to be purchased in Canada. The 30-year, 3% interest loans carry a 7-year grace period.

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### QUEBEC PLANS SPECIAL SUBSIDY

Quebec is planning a special subsidy for 500 lobster fishermen of the Isles-de-la-Madeleine to encourage them to fish for other species after the lobster season closes. Ordinarily these people, having no alternative to fishing for their livelihood, draw welfare money most of the year. The subsidy will be limited to inshore fishermen who catch between 10,000 and 50,000 lbs. of cod, plaice, and halibut per year in boats less than 50 ft. long. Maximum subsidy would be \$1,500 per boat.

The Isles-de-la-Madeleine have a perennial welfare problem. The plan, which would cost no more than \$360,000, could save the province \$300,000 in welfare payments. (U. S. Consul, Quebec, Aug. 16 & 22.)







Dean of the Helsinki (Finland) fish market. This 87-year-old woman has been selling fish and shellfish for 65 years in the open-air market. She is counting her stock of crabs. (Photo: Edelsberg)



## EUROPE

### USSR

#### LARGE PURSE SEINES SLATED FOR MURMANSK FLEET

The Murmansk Fishing Gear Factory has manufactured a purse-seine net over 720 meters (2,362 feet) long and weighing 18 metric tons. It was delivered to the Murmansk trawler fleet; 10 more will be delivered by the end of 1968. Seiners will be capable of fishing below 200 meters (656 feet). ("Vodnyi Transport," May 23.)

#### Years of Preparation

As early as Sept. 1965, ATLANTNIRO (Atlantic Scientific Research Institute for Fisheries and Oceanography) was testing off Iceland purse seines 650 meters (2,132 feet) long and 170 meters (558 feet) high. In autumn 1966, vessels of the Northern Fisheries Administration were purse seining in the North Atlantic. Results were mixed, mostly due to the inexperience of Soviet fishermen with the method.

The latest tests with large purse seines--700 meters (2,296 feet) long, 160 meters (525 feet) high--manufactured by the Murmansk Fishing Gear Factory were made off Norway in March 1968. Apparently, they were successful. The serial manufacture of the nets followed.

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#### MURMANSK FISHERIES BESET BY PROBLEMS

Plans to introduce changes at the Soviet Northern Fisheries Administration in Murmansk are in full swing, but the fisheries still operate under the old system. Improved planning, revised price indices, catch charts, etc., will not help unless effective measures are taken to improve port, fleet, and fish-processing operations.

#### Murmansk Port

In the fishing port, unloading vessels takes twice as long as in the commercial port, although both ports have identical equipment. Further delays are caused by frequent railroad-car shortages. The delays reduce the

number of fishing vessels at sea. Losses to the industry run into thousands of rubles. Operations at the fish-processing combine are predominantly manual, which make it impossible to increase productivity and profits.

#### Herring Fishery in Trouble

The herring fishery also is in trouble. Both fleet and fish-processing combine lack facilities for processing large catches. It is unprofitable to expand processing because of high wages authorized in Arctic regions. Elsewhere in the Soviet Union, fish-processing plants are willing to purchase frozen herring at prices considerably below cost. Current herring prices are so low the Murmansk fisheries have lost interest in catching herring.

#### Only 3 Herring Products Available

Only 3 herring products--fresh-frozen, smoked, and heavy-salted--are readily available despite the fact that 150 have been tested and 20 introduced for mass production. The assortment is determined not by demand but by processing technology; if processing is simple, the product is manufactured. ("Ekonomicheskaya Gazeta," June.)

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#### KALININGRAD-BASED FLEETS ARE IN THE ATLANTIC

In early July, several Kaliningrad-based fishing fleets fished in the Atlantic from Newfoundland to the tropics. One fleet fished for cod, haddock, flounder, and halibut off Newfoundland. Daily catch averaged 200 metric tons of high-quality fish suitable for quick-freezing. One large and 80 medium trawlers took herring and groundfish on Georges Bank. Daily catch exceeded 1,650 tons; part was frozen and part salted. Daily catch was around 450 tons in the southeast Atlantic. The mothership "Larkii Luch" and her fleet fished for tuna in the tropical Atlantic.

#### Accent Quality

Soviet fishermen are concentrating more on quality of catch. Landings of fish for which domestic demand is low have dropped, while catches of halibut, hake, flounder, mackerel, and cod have been increasing steadily. ("Vodnyi Transport," July 4.)

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## USSR (Contd.):

## TO STUDY PACIFIC FUR SEALS

Soviet scientists aboard the research vessel "Krylatka" this summer studied the migratory routes of fur seals--their movements, numbers, and length of stay at each rookery. They tagged over 1,000 individual seals in the North Pacific. ("Vodnyi Transport," May 21; "Pravda," June 4.)

## Study Results

Tagging has made it possible to compile a chart of seal migrations in the Pacific. According to the latest Soviet estimates, fur seal herds on the Commander Islands are growing rapidly. In the past 10 years, they increased fivefold: to 2,500. Soviet scientists claim this is due primarily to the 1957 Convention prohibiting pelagic sealing signed by the U. S., the USSR, Japan, and Canada.

Since early July, U. S. scientists have been visiting the Commander Islands rookeries.

## The Vessel

The Krylatka belongs to the research fleet of the Pacific Scientific Research Institute for Fisheries and Oceanography (TINRO). From November 1965 to February 1966, she conducted biological studies on Pacific fur seals in the Sea of Okhotsk and the Sea of Japan. Herds of up to 200 seals were sighted frequently.

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## ORDERS 12 REFRIGERATED FISH TRANSPORTS FROM FRANCE

French shipyards will build 12 refrigerated fish carriers for the Soviet Union. The agreement was signed in Moscow in early May 1968. It is the largest order ever placed by the Soviets in France. Spread among 5 shipyards, it amounts to about 460 million French francs (US\$93 million).

These vessels establish 2 new classes and will be "the largest ever designed." They will supply food, fresh water, and fuel to Soviet deep-sea fishing fleets, serve as passenger carriers to exchange fishing crews at sea, and carry home salted or frozen fishery products.

## The 12 Vessels

The Soviet order involves:

- (1) Ten vessels, 8,600-10,000 deadweight tons each. Length overall 164 meters or 537.9 feet, speed 17.5 knots, 2 engines 5,580 hp. each.
- (2) Two vessels, 12,500-15,000 deadweight tons each. Length overall 186.20 meters (610.7 feet), speed 18.9 knots, 2 engines 7,400 hp. each.

The vessels are scheduled to be delivered to the Soviets between April 1970 and July 1971. ("La Pêche Maritime," May 20.)

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## CASPIAN HAS CONSERVATION PROBLEMS

The Ministry of Fisheries was criticized in March by the Central Committee of the Communist party for mismanagement of the fish conservation program in the Volga-Caspian Basin. Water pollution, gradual depletion of spawning salmon stocks, and other conservation problems followed erection of a giant hydroelectric power plant on the Volga at Volgograd. The plant reduced the Volga's flow and accelerated contraction of Caspian waters.

Plans for 1971-1975 include construction of channels to bring water from the northern rivers to replenish Caspian water.

## Remedies Proposed

The State Planning Commission has approved recommendations of the Ministry of Fisheries to improve the situation. These prohibit use in seismic prospecting of explosives and other substances harmful to fish and seek to prevent water pollution from petroleum products, chemicals, and other toxic substances.

The State Supervisory Committee is investigating why a water divider (probably an artificial spawning channel) in the Volga Delta has not been completed. The Ministry of Fisheries has been blamed for holding up completion of the divider by failing to finance excavation of ponds and to develop the Aleksandrov spawning and breeding grounds. ("Ekonomicheskaya Gazeta," March and June 1968.)

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## USSR (Contd.):

## SURVEY SPINY DOGFISH OFF OREGON

In 1967, Soviet researchers surveyed the area off Oregon and Vancouver Island for spiny dogfish (*Squalus acanthias*). The liver is valued for its high vitamin A content. Schools of commercial importance were found at depths from 246 to 1,476 feet. The largest concentrations were spotted with hydroacoustic devices between 328 and 1,148 feet, where up to 30 metric tons were caught in exploratory 6-minute trawls. Temperatures at the bottom ranged from 6.9° C. to 8.1° C. (44.4°-46.6° F.). In the 30-ton catch area, water temperature was 7.5° C. (45.9° F.).

## Lengths and Heights

Lengths varied from 27½ to 33½ inches, with the average 30½ inches; average weights were 5.1 lbs. Stomachs of half the catch were filled with smaller fish and squid. Inadequate knowledge of spiny dogfish biology has kept the Soviets from developing a commercial operation in the area. ("Rybnoe Khoziaistvo," May.)

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## SCIENTIST SAYS FISHERY STATISTICS ARE POOR

Discussing prospects for marine farming, B. E. Bykhovskii of the Soviet Academy of Sciences said much more must be known about Soviet catches in order to plan for this new field. This is impossible now, he stated, "because fishery statistics are very poorly kept in our nation. These statistics should give precise information about the catch of various species, fishing areas, seasons, and quantitative indices. At present these data are not available." ("Trud," May 9.)

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## STARTS 'MAN IN THE SEA' PROGRAM

The Soviet underwater research laboratory "Chernomor" was lowered 16 feet into the Black Sea on June 29. Chernomor is a 55-metric-ton steel cylinder, 10 feet in diameter and 26 feet long, and carries a crew of 4. Air comes from high-pressure cylinders. It is equipped with scientific instruments, air purifiers, moisture absorbers, and a hot-water shower.

## Its Mission

The crew is to carry out complex oceanologic investigations, observe marine fauna, study the dynamics of bottom-sediment displacements, and test physiologic response of man to an underwater environment.

When the tests at 16 feet are completed, the Chernomor will be lowered 39 to 49 feet for further research. Eight 4-man crews have been trained for the program. ("Sovetskaya Rossiya," June 28 and 30; "Vodnyi Transport," July 13.)

In late July, a storm in the Black Sea made it necessary to raise the underwater laboratory with its crew. The oceanographic research vessels "Akademik Vavilov" and "Akademik Obruchev" stood by. ("Izvestia," July 25.)

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## STUDIES EFFECTS OF HOT WATER DISCHARGES ON INLAND WATERS

The Scientific and Technical Council of COMECON, the USSR and East European Common Market, is studying the effects produced by heated water discharged from thermoelectric power stations into inland waters. Discharge of heated water causes substantial changes in the thermal, physico-chemical, and biological conditions of natural reservoirs.

The Council has worked out a research program to: (1) determine thermal changes; (2) study physico-chemical phenomena; (3) determine changes in the biology of natural reservoirs.

Results should be available in early 1969. ("Rybnoe Khoziaistvo," June 1968.)

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## DISCOVERS 'ECHO-SOUNDER' IN STURGEONS

Soviet biologists have found the sturgeon (*Huso huso*) can emit low-frequency signals and receive their reflections. The scientists believe the fish has an unknown organ that does this. This 'echo-sounder' enables the sturgeon to navigate in the dark.

Discovery of this organ and how it works could open new vistas to radar science. ("Rybnoe Khoziaistvo," May.)

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USSR (Contd.):

#### 'AIR CUSHION' DEvised TO CONTROL ICE THICKNESS ON LAKES

Shallow lakes may freeze almost to the bottom and kill fish. To prevent this, a Soviet engineer has suggested pumping air through small holes drilled in the ice after it is 5 to 8 inches thick. If the holes are quickly sealed with clay or wet snow, an air cushion will form under the ice. This would prevent its downward spread and save the fish. If this method works on a large scale, catch yields per hectare may increase considerably. ("Rybnoe Khoziaistvo," May.)



#### Denmark

##### **GUARANTEES MINIMUM PRICE FOR PLAICE**

The Danish Government has appropriated 2 million kroner (US\$267,000) for a pool-fund to assure fishermen a minimum of about 6.1 U. S. cents a pound for the lowest-grade plaice. So long as prices remain above the minimum, fishermen will contribute to the fund about 0.2 cent per pound of plaice landed.

##### **Fishermen's Proposals**

Fishermen originally had proposed a minimum price of 1.30 krone per kilogram, and a provision for rationing catches of plaice "in order that supplies could better be adjusted to demand." The government's Monopoly Board refused these proposals. Fishermen say that if the proposals are not accepted they will have to seek government subsidy to survive.

##### **Minimum Prices For Other Species**

Government and fishermen representatives have formed a special committee to discuss establishment of minimum prices on other species. (Asst. Regional Fisheries Attaché, U. S. Embassy, Copenhagen, July 5.)

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##### **DANES BUILD LARGE FISHING PORT**

A new port at Hanstholm in northern Denmark is being built at a cost of US\$21.6 million. Seventy of an expected 500 vessels

already are operating out of the nearly completed harbor. Shore-based facilities will be developed next.

Fishing and commercial docks, ice plant, shrimp-processing plant, 2 cod-liver oil factories, and an auction hall already have been completed. A fish meal plant and 2 more auction halls to handle the anticipated large volume of landings are planned for future construction. ("Fishing News International," June 1968.)

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##### **CEASES IRRADIATION RESEARCH**

The Danish Ministry of Fisheries has terminated research on irradiation preservation. Its reasons: (1) undesirable changes in flavor of irradiated fish products and (2) import of irradiated fisheries commodities is prohibited by most countries. The research yielded much information that will be valuable if work is resumed.

Studies on fresh rainbow trout were carried out at the Risø atomic research station. Normally, the fish can be held in fresh condition for 14 days; irradiation and storage at temperatures just above the freezing point extend this to 21 days. During the last 7 days, however, enzymatic action sometimes causes undesirable flavor changes and lowers overall quality. Net gain for the product from irradiation was considered minimal. (Asst. Reg. Fisheries Attaché, U. S. Embassy, Copenhagen, July 5.)

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##### **'LIQUIDITY' LOAN TO FISHERMEN IS EXTENDED**

Danish fishermen are in trouble because of a long period of declining prices for catches and ever-increasing operating expenses. More than 60 firms supplying fishermen in the north Jutland ports of Skagen, Hirtshals, and Hanstholm have been forced to stop credit because they are extended as far as possible.

##### **New Loans**

To ease the situation, the Royal Danish Fisheries Bank is issuing a series of 10-year obligations to help carry fishermen through the difficult period. The program has a limit of US\$3.3 million. (Asst. Regional Fisheries Attaché, U. S. Embassy, Copenhagen, July 5.)

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## Denmark (Contd.):



Fig. 1 - Fishing port of Hirtshals on Northern Coast of Denmark's Jutland Peninsula. About 300 boats, mostly small (19 tons), fish waters of Skagerak, to the east, and North Sea, to the west. Their catches are mostly haddock, herring, plaice, sild, catfish, and shrimp. Part is sold to Britain as industrial fish. (Photos: Edelsberg)



Fig. 2 - Hirtshals. 2 of 3-man crew and son of owner (r). They fish for herring. Father does not want son to be fisherman--job is hard and income uncertain, he says. Each man averages about US\$4,000 a year.



Fig. 3 - The third man checks new 84-meter-long terylene net.



## Denmark (Contd.):



Fig. 4 - Hirtshals. 3-man crew of 33-ton fishing vessel catches herring, haddock, whiting, and shrimp. Each man averages US\$4,000-\$5,000 a year.



Fig. 5 - Dragør, near Copenhagen, Denmark. Fisherman (l) is extricating groundfish from tangle net. Ten nets, each 80 meters long, are set at night and pulled in morning.



Fig. 6 - Fisherman lowers net in which to keep fish alive. Part of catch is sold off boat, remainder is trucked to Copenhagen.

## Denmark (Contd.):

TRAWLER IS EQUIPPED WITH  
TRAWL BLOCK AND FISH PUMP

"Karsten Wernerfelt" from Hirtshals will be the world's first trawler fitted with a new trawl block and hydraulically driven fish pump. The two pieces of equipment, produced by the Norwegian firm A/S Hydema and Co., cost about US\$8,000. The cost can be justified on trawlers of more than 80 gross registered tons.

## Operation

The trawl is emptied by bringing it alongside the vessel and attaching a suction hose to the cod end. The other end is lifted with the trawl block, pressing the catch into the intake hose. The 1,400 r.p.m. pump is capable of handling 150 metric tons of fish per hour. A full cod end containing 30 tons can be emptied in 10 to 12 minutes, regardless of weather and sea conditions. Emptying a catch of this size usually requires 4 to 7 hours in bad weather.

## Will Lighten Work

The new equipment will replace one crewman and ease the work of the rest. The captain of the Karsten Wernerfelt is enthusiastic about the new equipment; a vessel cannot "wait for weather" if fishing is to be profitable, he said. (Asst. Reg. Fisheries Attache, U. S. Embassy, Copenhagen, July 5.)



## Norway

## INCREASES SUBSIDIES

The Storting (Parliament) approved unanimously a government proposal to support Norwegian fisheries from June 1, 1968, through May 31, 1969. Total government subsidies are estimated to increase 18% from a year earlier to about US\$32 million for the year ending May 31, 1969.

The exact subsidy amount can only be estimated because first-hand price support payments are based on volume of catches of eligible fish species; also, supports to reduce the cost of tackle, gear, and bait depend on amounts of such items actually bought.

## Aid to Vessel Owners

The Storting also has approved a US\$2 million loan arrangement for owners of fishing vessels hurt by this year's failure of the winter herring fishery.

## State Supports Continue

The current year, which ends May 31, 1969, completes the 5-year period in which the Norwegian Fishermen's Union and the government pledged to make the fisheries independent of State price support. (This is the General Fisheries Agreement of 1965.)

The agreement's main objective has not been reached. On the contrary, state price support has been rising since 1954/55. This took place despite the fact that deliveries of herring, mackerel, and other fish for reduction purposes have been excluded from price support since 1966.

## To Reevaluate Fisheries Soon

Einar Moxnes, Minister of Fisheries, indicated during the Storting debate on the current fisheries subsidy agreement that Norwegian fisheries and, particularly its sales and marketing aspects, would be reevaluated soon. (U. S. Embassy, Oslo, June 25.)



## Iceland

## HERRING FISHERY STRIKE SETTLED

The herring fishery strike was settled the first week of July when the State Herring Board set the price for raw herring paid by processing plants slightly higher than last year's. Herring-boat owners agreed to some increased wage benefits, and the government agreed to provide financial assistance to vessel owners and processing plants.

The new price, based on the low price for herring oil, promised to benefit neither vessel owners nor processing plants.

## Gains for Fishermen ✓

Following the price decision, owners agreed to grant fishermen: (1) increase in life and disability insurance from US\$35,000 to US\$70,000; (2) US\$19 a month for clothing;

## Iceland (Contd.):

(3) increased wages of US\$11 a month for engineers, cooks, and net-repairers; and (4) 24 hours' leave after 3 weeks at sea. Also, vessel owners agreed to pay fishermen a fixed amount per barrel of herring salted at sea.

## Government Plans Help

At the same time, Eggert G. Thorsteinson, Minister for Fisheries, announced that the government would help herring boat owners and processing plants by easing interest and installments on capital loans. The government would propose in the Althing this fall compensation up to US\$526,000 for the herring industry.



## France

## FISH INSPECTION

Several agencies share responsibility for fish inspection in France: (1) Institut Scientifique et Technique des Pêches Maritimes, Ministère de la Marine Marchande--responsible for sanitary controls at point of manufacture; (2) Service Veterinaire, Ministère de l'Agriculture--in charge of sanitary control of landed fresh fish; (3) Service de la Repression des Fraudes et Controle de la Qualite, Ministère de l'Agriculture--responsible for sanitary control once fish reach the trade; (4) The Ministère des Travaux Publics and the Ministère de la Sante Publique assist the above agencies.

## Methods

Fish inspection in France, and her overseas possessions, is mandatory for all products. It applies also to foreign and domestic trade. Laboratory tests are performed periodically at ports of debarkation, canneries, wholesale and retail levels. Most inspectors are agents of the Institut Scientifique et Technique des Pêches Maritimes and of the Service Veterinaire. (U.S. Embassy, Paris, July 24.)



## Italy

## MOTHERSHIPS BUILT

The M/S "Doroty Seconda," a freezer-fishing vessel built for the Sicilian firm OCEANFRIGO by an Italian shipyard, was launched on June 24. Her twin, "Doroty Prima," was launched 3 months earlier.

Specifications are: length between perpendiculars 274 feet; breadth, 40 feet; dead-weight tonnage, 1,550 tons; 2,400-hp. engine capable of 15.7 knots. The vessels are equipped with all the latest instruments and gear. They are supplied with long-line fishing equipment and carry crews of 40. Each has 4 refrigerated holds with varying temperatures and a total capacity of 1,200 tons. Cost is about US\$2.4 million each.

## To Be Motherships

The vessels will serve as motherships for a fleet of 4 smaller trawlers, either newly built or used, which OCEANFRIGO is interested in obtaining from foreign sources, including the U. S.

Doroty Prima sailed on her maiden voyage in July. Although equipped to handle all sorts of finfish, she will concentrate on tuna fishing off the African west coast. (U. S. Consul, Palermo, July 10.)



## United Kingdom

## NEW VESSEL BUILT IN POLAND

The flag was raised on the "Boston York" in the Gdynia Shipyard on June 28. The vessel is the second in the series of B427/A trawlers built there for the owners: Boston Deep Sea Fisheries, Hull, England.

The "Boston Concord" was handed over in 1965. The "Boston Lincoln," prototype of B427/A series trawler, was delivered in April 1968. The Boston York is the third trawler constructed by the Gdynia Shipyard for the Hull company.

## Fishing Stern Trawlers

The B427/A type units are fishing stern trawlers designed for North Sea and North

## United Kingdom (Contd.):

Atlantic grounds. Length overall is 64.40 meters (211 ft.); breadth 12 meters (39.4 ft.); draught 5.00 meters (16.4 ft.); deadweight 500 tons; speed 14.5 knots; hold capacity about 600 cu. meters (21,189 cu. ft.); crew 26.



A main engine developing 2,500 hp. drives an adjustable pitch propeller through a transmission gear. The latter drives 2 BC generators: one of 315 kw. drives the trawl winch motor, the other of 350 kw. feeds the mains. Insulated holds can store fish on ice, or in a temperature as low as  $-29^{\circ}\text{C}$ . ( $-20.2^{\circ}\text{F}$ .)

### Other Construction

Besides the Boston Lincoln and Boston York, Gdynia Shipyard is constructing 2 modernized trawlers--the B427/B version--for another British owner, Boyd Line Ltd., Hull. ("Polish Maritime News," July 16.)

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## WHITE FISH AUTHORITY LOWERS INTEREST RATES

The British White Fish Authority lowered its interest rates on fishery loans effective Aug. 10. The action resulted from a change in interest rates by the Treasury.

The new rates are:

Fishing vessels, new engines, nets and gear:

On loans not over 5 years,  $8\frac{1}{4}\%$ --decrease  $\frac{1}{4}\%$ .

On loans over 5 years but not over 10 years,  $8\frac{1}{4}\%$ --down  $\frac{1}{8}\%$ .

On loans over 10 years but not over 15 years,  $8\frac{1}{8}\%$ --down  $\frac{1}{8}\%$ .

On loans over 15 years but not over 20 years,  $8\frac{1}{8}\%$ --down  $\frac{1}{8}\%$ .

### Processing Plants

On loans not over 5 years,  $9\%$ --down  $\frac{1}{4}\%$ .

On loans over 5 years but not over 20 years,  $8\frac{1}{4}\%$ --down  $\frac{1}{8}\%$ .

The rates on loans made before Aug. 10 were unchanged. ("Fish Trades Gazette," Aug. 24.)



## East Germany

### FISHERY TRENDS

East Germany has converted about 10 trawlers for purse seining and is using them to fish herring in the northeast Atlantic between Iceland and Spitsbergen. Total daily catches average about 200 metric tons. Since purse seining is new to East German fishermen, Soviet gear specialists are training them. Twenty regular East German trawlers are processing the catch, and 2 chartered Soviet refrigerated fish carriers are hauling it to Rostock.

Changes in fishing technique and area were caused by reduced catches in East Germany's traditional fishing grounds in the North Sea. ("Berliner Zeitung," June 9; "Neues Deutschland," June 16.)



## East Germany (Contd.):

### Distant Water Fishing

The Soviets also will deliver a 3,000-gross-ton refrigerated fish transport to the Rostock Fisheries Combine to help East German vessels fishing off East Africa.

Rostock-based vessels were expected to fish Georges Bank during the summer. ("Neues Deutschland," June 16.)

### To Use Computers

Under the new economic system, "profits" are more important than production. East Germans plan to equip their high-seas fishing fleets with automated data-processing machinery. Vessels will teletype daily reports on catches, weather, currents, and other data to the mothership. A small computer will process and relay these to home port. There, a larger computer will guide the fleet to the best fishing grounds. The first data processing system is to operate at the Rostock Fisheries Combine. ("Der Morgen," July 11.)



## West Germany

### INDUSTRY CONSIDERING ON-BOARD IRRADIATION

The president of the Society to Promote the Irradiation of Foodstuffs has outlined the possibilities of improving the efficiency of the W. German deep-sea fishing fleet through irradiation equipment. Irradiation lengthens the storage life of fish. So the time at sea of trawlers operating out of German ports and landing fresh iced fish could be extended from the present 12 to 18 days.

Isotope irradiation equipment for use aboard a trawler would cost about US\$150,000-200,000. The quality of fish treated with radiation would be improved. Such fish would bring higher prices. Equipment capable of processing one ton of fish per hour might be amortized within 18 months, with an additional charge of US\$10 a metric ton.

### Government Aid Sought

Relatively small amounts of radiation energy would be used. This would exclude

possibility of harmful radioactive contamination. The Society has requested the government to fund installation of irradiation equipment for testing purposes aboard the government-owned fishery research vessel "Walther Herwig." The Federal Fishery Research Board at Hamburg supports the Society's request.

The Society hopes to bring about amendment of the Food Law that prohibits irradiation of foodstuffs. Existing measuring devices cannot detect radiation treatment permitted by several foreign countries. Therefore, it is possible that irradiated foodstuffs already have been imported into West Germany. (U. S. Consulate, Bremen, June 14.)



## Poland

### PLANS FISHERY EXPANSION

Polish economists and fishery administrators are planning ahead to 1985. Planning is based on future consumption estimates of about 18-20 kg. (39.6-44 lbs.) per year per capita. However, critics point out that because of many variable factors, such as future income per capita, quality and price of fishery products, etc., it is difficult to predict future demand exactly. Some estimate per capita consumption as high as 25 kg. (55 lbs.); others believe it will not even reach 18 kg. (39.6 lbs.).

### Estimated Production

Preliminary studies by the Institute for Marine Fisheries at Gdynia indicate that the 1965 output of fishery products--133,500 metric tons--will almost double by 1970 to about 240,000 tons, and triple by 1980 to over 400,000 tons. On the basis of these estimates, plans are being made for increases in catch and for new fishing-vessel construction.

### Estimated Catch

According to "Polish Maritime News," the 1967 catch amounted to 321,000 metric tons, including small fresh-water catches of 18,000-20,000 metric tons. Planners expect marine fishery catch to increase to 470,000 metric tons in 1970, 880,000 tons in 1980, and 1 million tons in 1985.



## Poland (Contd.):

The greatest production increase will be in fish fillets: in 1970, 140,000 tons of the catch will be used for fillets; in 1985 almost half a million tons. Cod, ocean perch, and hake will be the principal species used in fillet production. In 1965, Poland produced 6,400 tons of marketable fillets; by 1970, production will increase to about 42,000 tons.



## Czechoslovakia

### ACCLIMATIZATION OF FISH IN FISH CULTURE STUDIED

In late November 1967, a Conference on Acclimatization of Fishes related to fish culture was held at the Fisheries Research Institute in Vodnany. The conference focused on culture and diseases of herbivorous fishes.

Over 20 participants discussed how to use the findings of scientists in practical, everyday fish culture. This would increase fish supply in land-locked Czechoslovakia. In 1966, the catch was only 11,500 metric tons; in 1950, it was only 3,500 tons.

### Long Imported Fish

For many years, the areas that constitute Czechoslovakia today imported at least 16 fish species for acclimatization. Most came from the U. S. and from the Soviet Union. Overall success was not good. Fish culturists did not know enough about the biology of various species to select the most suitable species and culture areas. ("Bulletin" of Vodnany Fisheries Research Institute, No. 2, 1968.)



## Romania

### BUYS TRAWLERS FROM POLAND

A state-owned fisheries company has ordered 2 large freezer trawlers from Polish shipyards. The vessels will be used in the Atlantic north of the 20th parallel. They will be delivered in late 1968 and early 1969. (U. S. Embassy, Bucharest, July 12.)

The first two freezer trawlers for Romanian high-seas fisheries were bought in Japan in 1964. Since then, Romania has joined the Tripartite (USSR, Poland, and East Germany) Agreement on Development of High Seas Fisheries. Poland has developed a fishing-vessel building industry among the best in the world. She even exports fishing vessels to Western Europe.

Romanians have fished in ICNAF sub-area 5 sporadically in past years. Lately, they have fished mostly off northern Africa.



## Greece

### FISHING INDUSTRY HAS PROBLEMS

The fishing industry is complaining that lack of progressive government policies and rising costs of production have cut deeply into profits. Among measures proposed to solve the problems are lowering interest rates on fishery loans, removing restrictions on sales prices, and regularizing loans.

Greece has begun a 5-year development program that may improve conditions. ("Alieia," June.)



## LATIN AMERICA

### Venezuela

#### CLAIMS 3-12-MILE TERRITORIAL SEA OFF GUYANA

Venezuela has claimed the waters 3 to 12 miles off a 150-mile stretch of the Guyana coast as Venezuelan territorial sea. She says navigation will not be affected in the area, but foreign fishing will not be allowed. Guyana is the former British colony of British Guiana.

#### Historical Boundary Dispute

A boundary dispute arose during the last century when both Venezuela and Great Britain claimed the area between the Esequibo River and the current boundary of Venezuela. In 1899, an arbitral commission decided in favor of Britain. Venezuela accepted the decision but later called it unfair. The issue has flared into heated controversy. Venezuela says that until the dispute is settled she will exercise sovereignty in the waters 3-12 miles out of the area--because she, unlike Guyana, claims a 12-mile territorial sea. The claim will have no effect on Guyana's 3-mile territorial sea.

#### No Effect on U. S. Trawlers

About 200 foreign shrimp trawlers, mainly U. S., operate near the area; most are based in Georgetown, Guyana. Industry sources see no immediate problems because most trawling takes place beyond 12 miles. (U. S. Embassy, Caracas.)



### Colombia

#### NEW FIRM PLANS TO FISH SHRIMP

A new Colombian company, "Fishing Consortium S. A.," plans to start shrimp fishing out of Santa Marta and Buenaventura in late 1969. It will use 15 vessels now being built in Colombian shipyards. Company president Ernesto Restrepo Osario said that almost the entire catch will be exported to the U. S. and would roughly double Colombia's shrimp exports to the U. S. during 1970-1975.

#### Financing and Management

Authorized and subscribed capital of the new company are US\$2.4 million and \$1.6 million. Equity capital will be about 80 percent private and 20 percent public. In addition, the firm has obtained close to \$1.9 million loan capital.

#### Foreign Firms Interested

The company has received numerous offers of financial participation or assistance from European countries. Thus far, the operation has been kept strictly Colombian. Management comes primarily from ex-employees of the Financial Corporation of Colombia, a principal stockholder. (U. S. Embassy, Bogota, July 12.)



### Ecuador

#### U. S.-OWNED TUNA FREEZING PLANT OPENS

Del Monte del Ecuador, C.A., formally inaugurated on June 22 its new US\$800,000 tuna-freezing plant in Manta, northwest of Guayaquil on the Pacific Coast. Del Monte is wholly owned by California Packing Co., San Francisco. The U. S.-equipped plant, located on 10 acres of ocean-front land, consists of 8 freezing tanks, each capable of freezing 12 tons of fish in 5 hours, and a 250-ton-capacity storage freezer (-20° F.)

The frozen tuna are trucked 2 miles from the plant to Manta's dock. Then they are transported by refrigerator ship to Del Monte's packing plant in Puerto Rico. The Ecuadorian plant employs 50 persons and, indirectly, 300 persons on fishing boats.

#### Seasonal Fishing

Since tuna fishing is seasonal (the poorest months are January, February, and March) Del Monte's plant is designed to handle either peak or minimum loads. Banks of 2, 4, 6, or all 8 freezing tanks can be operated, depending on the catch. Del Monte owns or has contracts with 20 boats. Operations started May

## Ecuador (Contd.):

8. The company plans to freeze 8,000 metric tons of tuna this year and 12,000 tons in 1969.

## Seiners to Come

The firm owns 1 purse seiner. It plans to bring down as many as 6 from the U. S. if market conditions are favorable. Each will cost about \$250,000. Del Monte also may install a dock to accommodate the refrigerator ships. This may not be practicable without constructing a breakwater. The sea is often too rough for loading operations.

Del Monte apparently has no plans to establish a tuna-packing plant in Ecuador. It intends to ship all its catch to Puerto Rico for canning. (U. S. Embassy, Quito, June 26.)

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## RULING CREATES FAVORABLE MARKET FOR FISH OIL

An August 9 ruling by the Monetary Board of the Central Bank of Ecuador reduced from 140 percent to 50 percent the advance deposit required for imports of various oils and greases, including fish and marine-animal oils. The action apparently was taken in response to greatly increased imports of fish oils, mainly from Peru. For example, fish-oil imports for first-half 1968 totaled 1,552.6 metric tons, compared with 110 tons during the 1967 period and 788.7 tons during all of 1967.

## Will Stimulate Market

The reduced advance deposit for items to be imported is expected to stimulate the market even further. Substantial increases in marine-oil imports are expected over the next several years. (Agricultural Attaché, U. S. Embassy, Quito, Aug. 23.)



## Peru

## ANCHOVY FISHING SEASON OPENS

The anchovy fishing season opened September 1 and most vessels were reported fishing. First reports indicate fishing poor, although that was not unusual for early September.

There were no labor problems because of a 30-day suspension of constitutional guarantees affecting all unions following a transportation workers' strike.

## 1968 Shipments Ahead of 1967

Fish meal stocks on hand July 31 were 361,977 metric tons; a large percentage was sold in advance. Shipments were 199,111 tons in June and 167,373 tons in July. This brought total 1968 shipments to 1,255,190 tons--about 30 percent ahead of the 883,398 tons shipped during 1967 period.

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## TIDAL WAVE DAMAGES FISHING FLEET

The strong tidal wave that recently hit Peru caused damage of over US\$2.5 million to the fishing industry. Thirty-six 100-ton-capacity vessels were hurled onto the beach, driven aground, or otherwise damaged. It was the worst disaster in the fishing industry since 1952. (National Fisheries Society, Aug. 12.)

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## FISHERY DEVELOPMENTS

The Fishermen's Union Federation has presented the Boat Owners Association with a long list of demands. These include:

(1) a 56% increase in the per-ton fishermen's share price paid for anchovy; (2) a base salary of US\$5 a day for captains and \$3 for crewmen when fish are not available; (3) profit sharing, and a bonus salary each May 1 (Peru's Labor Day); and (4) a 50-percent increase in pay for trips exceeding 18 hours.

In April, the price paid for anchovy as the fishermen's share was \$2.60 a metric ton.

## Plant Bought

Frigorificos Paita, S. A. (FRIPSA) will be purchased by Star-Kist Foods, California, a division of H. J. Heinz. FRIPSA, which has cold-storage facilities, will be used to store frozen yellowfin and skipjack tuna for export.

## Giant Anchovy Seines

Rayon Celanese Peruana (RAY CEL) has sold the first 2 of its giant anchovy seines. Each seine is 440 fathoms long by 45 fathoms

## Peru (Contd.):

deep and has 3 bunts. Made of knotted webbing, the individual panels of the nets weigh 18,500 pounds each. The seines will be fished from 350-ton wooden vessels. ("Pesca," April.)



## Chile

REPORT ON ANCHOVY CATCH,  
FISH MEAL AND OIL PRODUCTION

During May, 1,480 tons of fish meal and 120 tons of fish oil were exported from Arica, and 1,960 tons of fish oil from Iquique. The oil, worth US\$249,700, was shipped to the U. S., U. K., West Germany, and the Netherlands.

During January-May, 62,900 tons of fish meal worth \$5,980,000, and 8,400 tons of fish oil worth \$472,700, were exported. Principal fish meal importers were the U. S. (40%) and West Germany (30%). The Netherlands received 96% of the fish oil.

The 147,400-ton June anchovy catch set a record. Despite a sharp reduction in the size of the fishing fleet and in the number of operating plants, 49% more fish meal was produced than in first half of 1967. A marked improvement in raw material yield--20.4% in 1968; 18.6% in 1967--contributed to this increased production. The price per metric

ton of fish meal in June varied between \$117-149. Consolidation of the fish meal industry in the north, aided by the record June catch, has had a favorable effect.



## Mexico

## FRANCE GIVES TECHNICAL ASSISTANCE

Experimental fishing by French trawlers has produced mixed results. Two vessels, one based at Progreso, Yucatan, the other at Mazatlan, Sinaloa, began operations last winter.

The Progreso project started with considerable fanfare. French fishermen arrived full of enthusiasm, ready to fish for large quantities of low-priced fish on extensive banks. They soon found that local fishermen, interested only in traditional high-priced shrimp and red snapper fisheries, could see no point in searching for low-priced species which, they believe, probably are not very abundant anyway. After several cruises, the trawler ran onto a coral reef. Emergency repairs were made and the vessel returned to France.

## Success in Mazatlan

The Mazatlan project was so successful that the Mexican government financed an extension. Some Mexican fishermen had expected to explore for shrimp in depths beyond the usual fishing grounds. The French and other fishermen had planned to explore for finfish. Few shrimp and numerous fish were caught, causing mixed emotions. The Mazatlan operation proved that there are enough fish to support large-scale trawling. Catches of mixed species averaged 6 tons daily. About half the species would be acceptable on the Mexican market, the rest could be sold in Europe.

## Other Operations

During September, the trawler cooperated in the Gulf of California resource survey, fishing in deeper waters than the smaller Mexican trawlers. Later it will move to Ensenada to explore the trawling possibilities along Baja California's west coast. (Reg Fisheries Attaché, U. S. Embassy, Mexico, Sept. 12.)



North Chile's Anchovy Catch, Fish Meal and Oil Production, Jan.-June 1966-68 <sup>1</sup>			
	1968	1967	1966
	(Metric Tons)		
<b>Anchovy catch:</b>			
June . . . . .	147,400	91,100	101,100
Jan.-June . . .	523,100	379,000	769,200
<b>Fish meal production:</b>			
June . . . . .	30,069	16,948	19,031
Jan.-June . . .	101,547	68,018	135,749
<b>Fish meal production from other than anchovy, south of</b>			
<b>Antofagasta:</b>			
June . . . . .	3,950	2,500	1,400
Jan.-June . . .	18,800	15,050	14,400
<b>Fish oil production:</b>			
June . . . . .	6,012	1,319	3,253
Jan.-June . . .	14,275	5,914	14,863

<sup>1</sup>/Statistics listed as received. Even numbers apparently are rounded.  
Source: Instituto de Fomento Pesquero, Informe Mensual No. 6, July 29; U. S. Embassy, Santiago, Aug. 5.



## ASIA

### Japan

#### CUT IN FROZEN FISH PRODUCTION IS PROPOSED

Trawl operators are having a harder time because of the shortage of bottomfish in both northern and southern waters and low prices. Yoshinosuke Yamazaki, board chairman of Kokusai Gyogyo, told the heads of such major fishing companies as Taiyo Gyogyo, Nichiro Gyogyo, and Nihon Suisan that "excessive production of frozen fish at the present time calls for some restriction on production and imports." On June 27, the companies discussed the matter with Fishery Agency Director Morimoto.

#### Financial Losses

According to Yamazaki, the fishing industry suffered a deficit of 5,270 million yen last year due to low prices for frozen fish and increased interest charges on loans and storage. In addition, the industry had 830,000 tons of frozen fish on hand at the end of the year. The recession trend in the market remains unchanged. If it continues, the industry will accumulate a deficit of more than 50,000 million yen.

#### Controls Requested

Yamazaki considers overproduction of frozen fish the fundamental cause. He has proposed:

##### Control over production and imports:

- (1) Limit imports to 130,000-150,000 tons.
- (2) Refrain from shipping into Japan fish valued at less than 60,000 yen per ton (small-sized merlusa, red fish, etc.). This is not to apply to Japanese fishing vessels transporting their own catches.
- (3) Refrain from purchasing and transporting by Japanese vessels fish selling for less than 75,000 yen per ton.
- (4) Japanese trawlers based at foreign ports should not ship to Japan fish valued at less than 50,000 yen per ton.

- (5) Require all Japanese trawlers to observe mesh restrictions that prevent taking small fish: small merlusa and red fish from Africa, silver cod from Alaska, and flounder from northern waters.

- (6) Make every effort to export merlusa fillets. The demand for these is increasing in foreign markets. To do it, attention must be given to a vessel's processing facilities and export promotion measures adopted.

- (7) Raise money through a 3,000-yen-per-ton tax to set up a compensation fund of about 500 million yen for losses caused by fishing suspensions.

#### Industry Cooperation

In addition to Yamazaki's proposals, the companies suggested a dumping prohibition and joint shipments of fish from distant waters. The major companies now recognize the need for joint industry action to conserve resources and maintain fish prices. ("Suisan Tsushin," July 6.)

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#### FROZEN TUNA EXPORTS UP, PRICES DOWN

Frozen tuna exports, which were slow in business year (BY) 1967 ending March 1968, increased sharply in April and May: 18,642 metric tons compared with 12,916 tons during the same period in 1967. The increase was due to good yellowfin catches in the Indian and Atlantic Oceans in April, and to good albacore fishing in the Atlantic from May.

Export prices, however, were sharply below those of 1967. Yellowfin shipments direct from Japan were \$410 a short ton c.i.f., California delivery, compared with \$460 c.i.f. in early 1967. Atlantic albacore transshipments to the U.S., which brought around \$500 per ton c.i.f. in 1967, were about \$450 per ton c.i.f. for large fish, and \$420 per ton for fish under 20 pounds. ("Suisan Tsushin," June 7.)

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## Japan (Contd.):

EXPORTS OF CANNED TUNA  
IN BRINE TO U. S. SLOW

Exports of canned tuna in brine to the U. S. were very sluggish during April and May, the first 2 months of business year (BY) 1968. Sales contracted by Tokyo Sales Co. totaled about 300,000 cases (48 7-oz. cans), or 10% of the 3-million-case export target for BY 1968. Normally, sales are brisk during April and May when U. S. retailers stock up for summer selling.

## Price Reductions Urged

Japanese trading firms attributed the drop to the high price of the Japanese product. They urged substantial price reductions and a vigorous sales-promotion campaign to overcome the slowdown. The Tokyo Sales Co. established export price of US\$11.20 per case f.o.b. for canned solid white meat tuna in brine is around \$14.80 a case on the U. S. wholesale market. This was about \$1.30 higher than the U. S. packer's price for private labels. Price quotations for the institutional pack were \$1-\$1.50 higher than the U. S. packer's price. Therefore, Japanese firms were believed to be contracting sales with U. S. buyers at prices well below the Sales Co.'s quotations.

## Packers Disagree

Japanese packers were in a difficult situation. They could not readily agree to a price cut since the raw material was costing them as much as \$467-479 a short ton. This was \$50 a ton too high, even for the established export price level for brine-packed canned tuna. ("Suisan Tsushin," June 6.)

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EXPORTS EXTRA-LARGE  
CAN OF BRINE-PACKED TUNA

The Japan Export Tuna Packers Association is encouraging the packing of tuna in brine in an extra-large can to improve sales in the U. S. institutional market--hotels, restaurants, schools, and hospitals. The can, "Special No. 1," holds 2,500 grams (5.5 pounds) drained weight, and 3,000 grams (6.6 pounds) net weight.

## The Can's Advantages

Successful marketing of U. S. machine-packed tuna in brine in recent years has created intense competition for the Japanese product in the U. S. market. Japanese packers believe the extra-large can would avoid direct competition with the U. S. pack and might overcome the slowdown of exports to the U. S. The extra-large can reduces packing costs for processors and brings greater profits to users because of lower buying cost and reduced handling time.

## Sales Prospects Seem Good

Packers planned to export 1,200 cases of the new pack before September and hoped to export another 2,500 by May 1969. Sales prospects are good because U. S. institutional buyers already have expressed interest in an extra-large can. ("Nihon Suisan Shimbu," July 17; "Suisan Tsushin," July 29.)

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CANNED TUNA PET FOOD  
EXPORTS DECLINE

Exports of canned tuna pet food to the U. S., which increased steadily in recent years, are declining. U. S. firms are not buying because the quality of the Japanese product is poor compared to the U. S. pack.

In 1967, Japan exported 1.4 million cases of canned tuna pet food to the U. S. Loss of the U. S. market is likely to be hard on tuna packers. ("Katsuo-maguro Tsushin," June 5.)

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## FROZEN SHRIMP IMPORTS DECLINE

Frozen shrimp imports in June totaled 2,324 metric tons valued at about US\$5.4 million, the lowest since January. The decline was ascribed to reduced buying by trading firms to "cool off" the oversupplied shrimp market. Imports from Mexico continued to decline sharply. Jan.-June imports of 19,342 tons were down more than 3,000 tons from 22,714 tons imported during the 1967 period. ("Suisan Tsushin," July 24, and "Suisancho Nippo," July 22.)

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Japan (Contd.):

## TANNER CRAB PRODUCTION TO REACH 7,000 TONS

The 1968 tanner crab production by fleets in the Bering Sea and North Pacific is expected to reach about 7,000 metric tons (legs only with shell). Bristol Bay king crab fleets should produce about 2,500 tons; Olyutorski fleets off Siberia 3,000 tons; and land-based vessels operating out of Wakkanai, Hokkaido, 1,500 tons.

In Bristol Bay, tanner crabs are taken incidentally by gill nets and crab pots fished by factoryship fleets led by "Keiko Maru" (7,537 gross tons) and "Dainichi Maru" (5,859 gross tons). Tanner crab production by the end of July was about 1,000 tons by the Keiko Maru fleet and 600 tons by the Dainichi Maru fleet.

The 2 factoryships are scheduled to continue operations until October. Nine crab fleets are taking large quantities of tanner crabs off Cape Olyutorski. While catch as of early August was unknown, it is estimated that the season's total production will not fall below 3,000 tons. ("Suisan Tsushin," August 3.)

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## BRISTOL BAY KING-CRAB FLEETS REPORT MANY TANNER CRAB

Japanese king-crab motherships "Keiko Maru" and "Tainichi Maru" (5,859 gross tons), fishing in Bristol Bay, reported early in June heavy incidental catch of tanner crabs. These crabs severely damaged crab pots and hurt king-crab production, which was running more than 30 percent behind 1967.

## Concentration on King Crabs

The abundance of tanner crabs was believed due to concentration of fishing effort in recent years on king crabs. Some Japanese feel it may be necessary to thin out tanner crabs to increase the yield of king crabs. ("Shin Suisan Shimibun Sokuho," June 11, & "Suisan Tsushin," June 8.)

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## SALMON MOTHERSHIPS RETURN WITH LOW CATCH OF REDS

The 11 salmon mothership fleets assigned to Area A, north of 45° N. latitude, in the North Pacific high-seas fishery returned to Hokkaido, the northernmost island, in late

July after about 2 months. This year's fishery was generally poor because of unusually rough seas and a higher than usual water temperature. Fleet commanders reported that red salmon catches were very low, only about 10-15 percent of the total catch. Catches of less profitable pinks were relatively high.

From the very beginning, the fleets encountered unusually stormy weather. Bad weather, particularly in the central grounds, caused wide movement of the fleet and even forced suspension of fishing for 10-13 days. Water temperature to mid-season was between 1-1.5° C. higher than average, advancing the season about a week ahead of normal years.

## Fish Runs Poor

On the whole, fish runs were poor. Large quantities of small-sized reds taken in July indicate that a good red salmon run might develop next year. Chums taken in northern grounds were larger in size, about 2.4 kg. (5.3 lbs.), and clearly distinguishable from those averaging about 1.8 kg. (about 4 lbs.), taken in southern grounds. ("Minato Shimibun," Aug. 1.)

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## FISHING POOR OFF U. S. EAST COAST

The stern trawler "Shirane Maru" (2,528 gross tons), commissioned by the Japanese government to conduct exploratory surveys in the northwest Atlantic, was catching cod and ocean perch off Labrador in mid-July. The vessel began fishing near 40° N. latitude off New York in early June. It caught mostly butterfish. From there she moved progressively northward toward Labrador, refueling at Saint Pierre off Newfoundland. Later, she crossed the Davis Strait and fished off the west coast of Greenland, but heavy ice drift forced her back to the North American coast.

Shirane Maru is not having much success. Catches to mid-July were about 200 tons of bottomfish. According to the owners, prospects of developing commercial fishing grounds in the northwest Atlantic remain uncertain.

## Other Trawlers

The commercial trawler "Akebono Maru No. 51" (1,454 gross tons), fishing off New York since mid-June, found too many small-size butterfish and departed for Las Palmas

## Japan (Contd.):

in late June. Two other trawlers, "Hidehiko Maru" (2,524 gross tons), and "Kaimon Maru" (2,518 gross tons), had more success fishing off the U. S. east coast in early July. However, they were scheduled to end fishing in late July for repairs. ("Minato Shimbun," July 18; "Shin Suisan Shimbun," July 8.)

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## SHRIMP FISHING OFF GUIANAS

On June 22, 51 Japanese shrimp vessels were fishing off the Guianas. Another 21 vessels were scheduled to join the fleet by the end of August. The 72 vessels will include 35 licensed for land-based operations out of Georgetown, Guyana; 22 based at Port of Spain, Trinidad, licensed for mothership operations, and 15 based at Paramaribo, Surinam.

Ten more Japanese firms also were interested in entering the fishery. The high market price for shrimp taken off the Guianas, low investment cost of small vessels, and relative stability of the resource are encouraging fishing firms to enter the fishery. However, the Japanese Fisheries Agency is not likely to permit further fleet expansion.

## Prices and Production

Fleet production reports showed the Japanese were catching and processing 350-400 pounds of shrimp, heads off, per vessel per day. Most catches were pinks and browns of fairly large size (under 25 count heads off to the pound). Delivery prices in the latter part of June averaged around US\$1.39 a pound ex-vessel and provided sufficient profit.

## Lack of Repair Facilities ✓

One problem facing the land-based operators is the lack of minor repair facilities on land for vessels and gear. The Japanese Association for Trawl Fisheries off the North Coast of South America is investigating the possibility of setting up small repair shops at Georgetown to service the shrimp fleet. ("Shin Suisan Shimbun Sokuho," July 10.)

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## SURVEYS SHRIMP IN SOUTHEAST ASIA

The Marine Products Importers Association is sending an 8-man shrimp survey team to southeast Asia on October 28. The team will travel to Thailand, Malaysia, Singapore, Borneo, Sarawak, and the Philippines to study the possibility of buying shrimp for shipment to Japan.

In 1967, the Association sent a similar mission to Pakistan and India. Seventy-five percent of the trip expenses will be financed by the Government's 64.2-million-yen (US\$178,333) subsidy program. The program promotes imports of unprocessed products, such as minerals, lumber, and agriculture-fishery products from underdeveloped countries. ("Suisancho Nippo," July 30.)

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## NEW TRAWL USED IN BERING SEA

A new all-purpose trawl that can be set for towing at all depths has been developed by Taito Seimo Fish Net Manufacturing Co. and Taiyo Fishing Co. The gear has shield-type otter boards specially designed to provide maximum net-spreading with minimum resistance.

## The Net

The net, about 100 meters (328 feet) long, permits wide opening of the mouth. It is equipped with a kite for buoyancy and has 530 600-millimeter (about 2 feet) steel bobbins for dragging rough bottoms. When a school is located, the net can be set for towing at the desired depth by adjusting the otters, kite, warp, and other connections. The new gear will be placed aboard Taiyo's stern trawler "Zuiyo Maru No. 3" (3,858 gross tons).

## The Zuiyo Maru No. 3

This trawler, one of the largest and most modern in Japan, has minced-meat and fish-meal plants. It is equipped with the latest sonar gear for trawling at 5 meters (16.4 feet) to 600 meters (1,968 feet). The vessel was scheduled to depart Hokkaido for the eastern Bering Sea in early August. ("Minato Shimbun," July 25 & 31.)

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Japan (Contd.):

### LONG-LINERS REPORT GEAR THEFTS OFF MEXICO

Tuna long-liners fishing off Mexico have reported thefts of fishing gear. One long-liner claimed her banners, radio buoys, lamps, and 20 baskets of mainline were stolen on July 12 while she was fishing near 23° 17' N, latitude and 108° 13' W, longitude off Mazatlan. One basket equals 650-1,300 feet of long line.

In the same area, on July 10, another long-liner encountered 2 foreign purse seiners and later discovered that 28 baskets of her long line had been cut off by a sharp instrument and removed. ("Katsuo-maguro Tsushin," July 23.)

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### TRAWLERS LICENSED FOR NORTHWEST ATLANTIC

The Japanese Fisheries Agency licensed for one year 3 commercial trawlers for experimental operations in the Northwest Atlantic, north of 40° N, latitude, off New York. The trawlers are: "Taiyo Maru No. 65," 1,829 gross tons; "Akebono Maru No. 51," 1,454 gross tons; and "Suzuka Maru," 2,529 gross tons.

#### To Observe ICNAF Rules

The vessels will be required to observe mesh-size regulations of the International Convention for the Northwest Atlantic Fisheries. ("Nihon Suisan Shimbun," June 12.)

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### SIGNS FISHING AGREEMENT WITH INDONESIA

The Japan-Indonesia fishery negotiations to ensure safe operations for Japanese vessels inside Indonesia's 12-mile limit were finally concluded on July 20. They began Dec. 1967. The 1-year pact may be extended after consultation.

Japanese vessels will be permitted to fish within designated zones in the Banda and Seram Seas. Okinawan vessels were accorded similar privileges in a separate agreement. ("Suisan Tsushin," July 22.)

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### TO SEND TUNA MISSION TO ITALY

The Ministry of International Trade and Industry (MITI) planned to send a mission to Italy in September to help develop a stable frozen tuna export market. The group would confer with Italian importers and packers on problems involving Japanese tuna, study frozen-tuna market conditions in Italy, and assess effects of the entry of other tuna-producing countries into the Italian market. ("Suisancho Nippo," July 30.)

日本

### Malaysia

#### EXPANDED TRAWLING BOOSTS CATCH

Trawling has expanded greatly in Malaysia. Prompted by Taiwan's and Thailand's great successes in trawling, the government determined that vessels of less than 75 tons can trawl economically in Malaysian waters. Licenses are issued to vessels fishing for cooperatives. One hundred and thirty vessels over 50 tons trawl legally; several hundred smaller ones trawl without license.

A dispute has erupted between offshore fishermen who operate the trawlers and inshore fishermen who claim that resources are being depleted by illegal trawling. The government has been compelled to intercede on several occasions. It has promised to stop illegal trawling in inshore waters.

#### Increase Catch

Fish production in Malaya State has increased over 50% in the last 2 years: from 198,000 metric tons in 1965 to 236,000 tons in 1966, and to 301,000 tons in 1967. Of the 65,000-ton increase between 1966 and 1967, 58,000 tons were estimated to have come from trawling.

#### Mechanize Vessels

Encouraged by the high profits of trawling, inshore fishermen are mechanizing their vessels and moving out to sea. In 1957, there were 1,700 nonpowered fishing vessels in Malaysia; now there are only 700. Vessels with inboard engines increased to over 10,000 from 1,500 in 1957; many trawl in inshore waters. ("Fishing News International," June.)

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## South Korea

### BERING SEA OPERATIONS

Samyang Fisheries Co.'s refrigerated carrier "Sam Su No. 201" returned to Pusan July 14 with 400 metric tons of Alaska pollock caught in the Bering Sea. Another refrigerated carrier, "Sam Su No. 301," and 6 catcher vessels continued fishing off the western Aleutians until July 20.

### Catch and Prices

Samyang's total catch was 796 metric tons, mostly Alaska pollock with some flounder and cod. The company invested 112 million won (about US\$407,000) in the venture. It probably will lose money because the catch was lower than expected and market value was less than anticipated. Originally, Samyang planned to catch more than 1,000 metric tons of Pacific herring, which sells at 100,000 won per ton, about US\$365, on Korean markets. Estimated sales value of the actual catch was only 30,000 won, about \$109 per metric ton, but Samyang was hoping for a sales contract at 35,000 won per ton.

### State-Owned Trawlers

The state-owned Korea Marine Industry Development Corporation (KMIDC) factory sterntrawler, "Kang Hwa No. 602," ended her month-long exploratory fishing cruise in the eastern Bering Sea on July 15 and returned to Pusan. KMIDC operations were separate from Samyang operations. Kang Hwa No. 602 carried about 400 tons of Alaska pollock and some herring. (U. S. Embassy, Seoul, July 23; "Oop Shinbo," July 22.)

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### BUYS FISHING VESSELS FROM JAPAN

Japan will build 54 fishing vessels for South Korea under the joint Economic Development Program for March 1967-December 1968. The cost will be US\$13.4 million.

S. Korea has ordered 35 otter trawlers for fishing off Indonesia and in the East China Sea, 10 tuna long-liners for the South Pacific, 3 sterntrawlers for African waters, and 6 refrigerated carriers and support vessels to service coastal fishing fleets. (U. S. Embassy, Tokyo, July 15.)

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South Korean fleet consisting of a 1,000-ton mothership and six 90-foot pair trawlers anchored in Dutch Harbor, Unalaska Island, in 1967. This was the first commercial venture of the South Koreans into the eastern Bering Sea following a preliminary survey by a ship in 1966. (Photo: Zahn)



## Communist China

### REACTS TO JAPANESE FISHING VIOLATIONS

In June, the Mainland China Fisheries Association protested Japanese fishing in prohibited areas of the China-Japan Private Agreement on Fishing in the East China Sea. Violations occurred in May and June in the vicinity of the mouth of the Yangtze River. The protest was directed to the West Japan Trawl Fishing Association, the Japanese Signatory of the Private Agreement.

#### 15-Day Fishing Halt

Such violations have occurred each year but have brought only mild warnings by the Chinese and apologies by the Japanese. This year, however, the Chinese demanded and obtained more drastic punishment. About 80 Japanese boats that had violated the agreement voluntarily stopped fishing for 15 days in July. ("Japan Times," July 13.)



## Pakistan

### FIRM BUYS 6 DANISH-BUILT TRAWLERS

Fishery Products, Ltd., is buying 6 trawlers from Danish shipyards to use in the coastal shrimp fishery. They will be about 67 feet long, displace about 80 gross tons, and carry Danish-built 240 hp. diesel motors.

All 6 vessels will sail to Pakistan in a group probably with at least one Danish skipper or fisherman aboard each. The Danes would remain with the fleet in Pakistan while Pakistani crews were being trained. (Asst. Reg. Fisheries Attaché, U. S. Embassy, Copenhagen, July 5.)



## India

### EXPORTS SHRIMP TO U. S.

Madras is fostering interest in the export of frozen shrimp to the U. S. and other overseas markets. Shrimp catch, 9% of Madras marine landings, has increased since 500 mechanized boats began trawling off Madras. About 10 to 15 tons of shrimp are collected daily from various coastal centers and shipped to Cochin for processing and export.

The Madras Government has opened its first freezing plant, which is capable of handling 3 tons of shrimp a day. Operated by the Indo Marine Agencies (Tamil Nad) Ltd., the plant can freeze 10,000 pounds of shrimp in 10 days. The first shipment of the frozen shrimp was exported to the U. S. on July 6.

Madras landings no longer have to be sent to the west coast, risking spoilage and incurring transportation charges. More freezing plants are to be established at Tuticorin and Mandapam. Private enterprise is being encouraged to start its own. Indo Marine Agencies alone expects to handle more than 150 tons of processed shrimp a year. (Madras Govt., July 6.)



#### WHAT CAUSES "TIDAL WAVES"?

"Tidal waves" are not caused by the tides, but by movement of the ocean floor. Their proper name is tsunami, a word of Japanese origin. They are also commonly called seismic sea waves.

Submarine earthquakes, landslides, or volcanic eruptions create tsunamis; a submarine disturbance may produce three or four waves with a wave length (crest to crest) greater than 3 miles, although their height over the open ocean may be only 1 foot. Speed of advance can exceed 500 miles an hour. As the waves approach shore, they are slowed and the water behind piles up to tremendously destructive heights. ("Questions About The Oceans," U. S. Naval Oceanographic Office.)

## SOUTH PACIFIC

### New Zealand

#### INCREASES FINANCIAL AID TO FISHING INDUSTRY

The New Zealand government plans to increase financial assistance to the fishing industry. The plan includes assistance for used fishing vessels, new engines for replacement, and for fishing gear and equipment. Increases in mortgage guarantees and loan limits to fishermen--and refinancing of existing loans on vessels--are included. Financial assistance to buy new and used vessels will be provided, both for individual fishermen and for wholly New Zealand-owned partnerships and corporate bodies.

Financial assistance for used vessels would be for those of 40-foot minimum length and maximum age of 15 years, with a current survey certificate, and suitable for the fishing project proposed.

#### For Engines and Gear

Assistance in buying new engines for replacement will be based on 66 $\frac{2}{3}$ % of the cost including installation, or \$10,000, whichever is less. Financial assistance also is provided to buy fishing gear and equipment where a change of method of fishing is involved and cost is significant. Such loans will be for a maximum of three years and up to two-thirds the cost of equipment, or \$10,000, whichever is less.

Mortgage guarantee assistance for new or used vessels will increase from 20% or NZ\$10,000 to 40%, or \$40,000, whichever is less; the applicant will contribute 33 $\frac{1}{3}$ % instead of the former 40%. State loan limits will increase from 50%, or \$30,000, to 66 $\frac{2}{3}$ % or \$60,000, whichever is less; the applicant contribution will be 33 $\frac{1}{3}$ % instead of the former 40%.

Interest rate for all loans will be 6%.

#### Refinancing Included

Refinancing for new or second-hand vessels will be provided if venture prospects are sound, assets are adequate, and the Minister of Finance approves.

These increases in financial aid, which should further industry expansion, conform with government's desire for full development of the industry at the earliest date. ("The Australian Fish Trades Digest," April.)

Note: NZ\$1.00 = US\$1.13.



### American Samoa

#### TUNA LANDINGS LEVELING OFF

The Japan External Trade Organization (JETRO) reports that total tuna landings at Samoa between January and April this year were 10,435 tons, or about 20% below the 12,772 tons for the 1967 period.

Landings by Japanese vessels totaled 1,718 tons, 16.5% of the total; landings for the 1967 period were 2,756 tons. The Japanese share for Jan.-Dec. 1967 was 24.4 percent.

#### South Korea and Taiwan

South Korean landings also declined: 3,671 tons for Jan.-Apr., against 5,112 tons for the 1967 period. However, South Korea's share was 35.2%--an increase over the average 34.6% for Jan.-Dec. 1967.

Landings by Taiwan, which have increased every year, leveled off at 4,480 tons in this period; in the 1967 period, 4,304 tons were landed. Taiwan's share has increased markedly--to 42.9% from the average 36.6% for all of 1967.

#### Fishing Improves

Fishing grounds around Samoa were extremely poor in February and March, but the catch recovered later to 1.5 tons per vessel per day. ("Suisan Tsushin," July 3.)



### Australia

#### TASMANIA ABALONE CULTURE

Tasmania's abalone fishery has grown so much in the past few years that it now ranks second as a money earner to the long-established spiny lobster fishery.



### Australian (Contd.):

The Fisheries Division is cooperating with 2 fish-processing firms in carrying out preliminary tests to determine the feasibility of abalone culture. The tests should help determine whether the culture of abalone is feasible--or whether juvenile abalone could be raised in farms or hatcheries to "seed" areas already fished. The program also should open other lines of research to help conserve the valuable industry.

### How Abalone Are Kept

Abalone are kept in tanks so their growth and behavior can be studied in detail. At the Dunalley Factory of Planet Fisheries Pty. Ltd., sea water for the captive abalone is first drawn into a 110-gallon polyethylene header tank by an electrically driven centrifugal pump. The water level is controlled by a

float switch acting on the pump and by a foot valve on the intake pipe.

To provide the abalone with home sites other than the walls of the tanks, empty abalone shells and well-washed concrete masonry blocks were placed in the water. Within a short period, all the animals took positions away from the light. A few moved under the empty abalone shells, but the most popular locations were the shaded surfaces of the concrete blocks.

### Fed on Algae

The abalone are fed on algae collected from shells in commercial abalone catches. After observation, 2 species of algae will be selected and tested as the first step in determining the most suitable food. ("The Australian Fish Trades Digest," April.)



Tahitian fishermen unloading small yellowfin and hanging them on a shoulder-pole for transportation to the market.



"**Fisheries Biology: A Study in Population Dynamics**," by D. H. Cushing, Univ. of Wisc. Press, 1968, 216 pp., illus., \$7.50. As the demand for food grows with the rapidly increasing world population, the measurement of the quality and extent of the world's fisheries becomes more important. Dr. Cushing describes methods by which fish stocks may be measured, conserved, and properly exploited. He stresses quantitative methods of measurement and application of mathematical concepts to fishery biology. He examines in detail methods of determining average age of different stocks, and the relationships of migrations and ocean boundaries to each other, and to the biology of fisheries.

"**The Biology of Estuarine Animals**," by J. Green, Univ. of Wash. Press, 1968, 401 pp., illus., \$9.50. The configuration of land and water at the meeting of a river and the sea was once crucial in the evolution of man, and is still the habitat of countless animal species. Mr. Green investigates the physico-chemical characteristics of a brackish sea environment, the vegetation that provides food and shelter, and the ways in which estuarine animals cope with their surroundings.

"**Fishing with Electricity: Its Applications to Biology and Management**," Fishing News (Books) Ltd., London, 1968, 304 pp., illus., £3 12s. 6d. The book contains the two-part proceedings of a symposium sponsored by the Food and Agriculture Organization in 1966. It offers the conclusions of an internationally integrated study on the application of electricity to inland fishery biology and management. The first part, a report on recent basic research on the electrophysiology of fish, summarizes present knowledge of electric fishing methods and gear. The second part, 14 papers studied by the symposium, is divided into sections covering the electrophysiology of fish, electric fishing practice, electric screens and guides, the electronarcosis of fish for handling, and an annotated bibliography of Soviet literature on electric fishing.

"**The Farming of Fish**," by C. F. Hickling, Pergamon Press, New York, 1968, 88 pp., illus., \$3.50. Fish farming, a practical application of limnology and freshwater biology to food production, is exciting much interest in parts of the world where it has not been common practice. Drawing on his own experience, C. F. Hickling, former Fisheries Adviser to the Colonial Office, has written a concise and informative text on fishpond management. It includes short discussions of the basic elements of fish farming, water quality and supply, pond soil, fish pond biology, stocking and species, and fish farming in the sea.

"**Ocean Engineering**," edited by J. F. Brahtz, John Wiley & Sons, New York, 1968, 720 pp., illus., \$17.95. Believing that an engineering systems approach is required to manage the complex marine environment, the editor and 16 contributors have tried to relate social, economic, and military needs to common technological goals. The environmental aspects and technological goals of marine development are dealt with in chapters on general features of the ocean, hydrodynamics, biology, law, economics, social and military needs, and systems development planning. Other chapters cover on-site technology of deep ocean installations, fixed and mobile structures, marine vehicles, instrumentation, manned operations and work systems, materials selection, testing, and environmental simulations. This book will interest planners concerned with engineering technology applied to the marine environment. Technical managers will find particularly useful the treatment of opportunities for matching social, economic, political, and military needs with existing and potential technology.

"**Marine Fishes of New Zealand**," by Jim Moreland, illustrated by Eric Heath, A. H. & A. W. Reed, Wellington, 1968, 56 pp., illus., \$2.25. This simple reference book for the fisherman or amateur ichthyologist identifies,

and illustrates in color, every fish likely to be taken in New Zealand waters. The common, Maori, and scientific names, salient characteristics, diet, habitats, and methods of catching are given for each species.

"A Preliminary Review of Alternative Federal Measures of Encouraging Private Investment Enterprise in Marine Resource Development," by Miller B. Spangler, Clearinghouse, Springfield, Va., 22151, 1968, \$3.00. The demands of a rapidly growing population for oil, chemicals, metals, energy, and freshwater leave no doubt that marine resources will have to be developed sooner or later. At present, conventional technology for farming, drilling, and mining land areas is so developed that exploitation of the oceans is not commercially competitive. Oceanics is a field in which the public interest may require new kinds of government-business cooperation. This National Planning Association report reviews more than 50 Federal measures that might stimulate private investment to develop marine resources.

Surveys of the marine science activities of 99 nations have been published by the National Council on Marine Resources and Engineering Development. The surveys describe the economic importance of marine activities to each country, the nature and scope of marine research, and the mechanisms for coordinating ocean endeavors. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, "Marine Science Activities of the Nations of the Near East and South Asia" is 30 cents, "East Asia," "Latin America," and "Africa" are 35 cents each, and "Canada and Europe" is 55 cents.

"An Oceanographic Curriculum for High Schools," by Robert Taber, Leon LaPorte, and Ellsworth Smith, 1968, 30 pp., 35¢, Superintendent of Documents, GPO, Washington, D. C. 20402. Prepared by scientists of the National Oceanographic Data Center, the booklet briefly outlines a flexible program of 18 lectures covering various areas of oceanography. Some subjects are "Man and the Sea," "Food from the Sea," "Air-Sea Interaction," "The Continental Shelf," "Limnology," "Conservation," and "Origin of the Oceans."

"Wire Angle Tables," adapted by John E. Rothrock, Cornell Maritime Press, 1968, 104 pp., \$5.00. These tables, adapted from Bow-

ditch, Table No. 3, should be a great help to oceanographers, marine biologists, fishermen and navigators. By providing instant solutions as the angle changes, they eliminate lengthy computations. They also offer an accurate method of estimating how much wire to pay out to reach a given depth for fishing or trawling, and for checking the accuracy of mechanical accumulators and tension meters.

"Mechanized Haul Seine for Use in Farm Ponds," by Kenneth L. Coon, Alfred Larsen, and James E. Ellis, FIR Reprint 57, Fish and Wildlife Service, Dept. of the Interior, 1968, pp. 91-108, illus. Available free from Branch of Reports, Publications Unit, BCF, 1801 N. Moore St., Arlington, Va. 22209. Present methods of harvesting fish from farm ponds are time consuming, laborious, and wasteful. The mechanized haul seine makes it possible to harvest fish from large undrained ponds, keeps fish ready for short-notice market requirements, maintains high quality even for live transfer, and cuts operating costs. This paper describes the design and operation of a mechanized haul seine and conveyor system developed to capture, load, and weigh fish into trucks for shipment. The seine works well in ponds ranging from 4 to 50 acres, and in water as deep as 8 feet.

"Operation of North Atlantic Type Otter Trawl Gear," FL-445, by Boris O. Knake, 15 pp., illus. Available free from Branch of Reports, Publications Unit, BCF, 1801 N. Moore St., Arlington, Va. 22209. Rigging, crew stations, and step-by-step operating instructions are fully illustrated and simply explained.

"Effect of Special Handling of Haddock on the Postirradiation Shelf Life of Haddock Fillets," by Vincent G. Ampola and Louis J. Ron-sivalli, FIR Preprint No. 58, Fish and Wildlife Service, Dept. of the Interior, 1968, 3 pp. Available free from Branch of Reports, Publications Unit, BCF, 1801 N. Moore St., Arlington, Va. 22209. The shelf life of haddock fillets can be doubled or tripled by proper irradiation. This is a report on special handling used to prolong shelf life, and tests used to determine quality of irradiated haddock fillets.

"Observations on the Physiological Ecology of Marine Fungi," a lecture by Samuel P. Meyers, Contribution No. 878, Institute of Marine Sciences, Univ. of Miami, pp. 207-225, illus. (reprinted from Bulletin of Misaki

Marine Biological Institute, Kyoto Univ., no. 12, Feb. 1968). Mycological aspects of marine microbiology are of considerable interest to scientists concerned with microbial transformation of complex substances in the sea. Dr. Meyers comments on the experimental aspects of Ascomycetes and Deuteromycetes, many of which attack wood, developed in the laboratories of the Institute of Marine Sciences over the past ten years.

"Ecology and Growth of Juvenile Tarpon, *Megalops atlanticus*, in a Georgia Salt Marsh," by William L. Rickards, Contribution No. 869, Institute of Marine Sciences, Univ. of Miami, 1968, pp. 220-239, illus. (reprinted from "Bull. Mar. Sci." vol. 18, no. 1, Mar. 1968). The tarpon Valenciennes undergoes metamorphosis from a leptocephalus larva to a juvenile much the same as the eel *Anguilla rostrata*. After reaching the shore, or shortly after moving into salt-marsh drainages, the larvae metamorphose. The next period of their lives is spent in marsh pools and creeks. This study was made to determine some of the relationships between the young tarpon and the biotic and abiotic environmental factors during this period.

"Studies of Phytoplankton Ecology in Tropical and Subtropical Environments of the Atlantic Ocean. Part 2. Quantitative Studies of Phytoplankton Distribution in the Straits of Florida and Its Relation to Physical Factors," by Gabriel Vargo, Contribution No. 866, Institute of Marine Sciences, Univ. of Miami, pp. 5-60, illus. (reprinted from "Bull. Mar. Sci." vol. 18, no. 1, Mar. 1968). Until 1957, the majority of phytoplankton studies along the eastern coast of the U. S. were limited to northern waters. This is a quantitative study of the phytoplankton in the Straits of Florida and the effects of physical parameters upon its vertical and seasonal distribution.

"The Complete Larval Development of the West Indian Hermit Crab *Petrochirus diogenes* (L.) Decapoda, Diogenidae) Reared in the Laboratory," by Anthony J. Provenzano, Jr., Contribution No. 867, Institute of Marine Sciences, Univ. of Miami, pp. 143-181, illus. (reprinted from "Bull. Mar. Sci." vol. 18,

no. 1, Mar. 1968). More information concerning the development of hermit crabs has been gathered during the last decade than in all the preceding years. This account of the complete zoeal development and the glaucothoë of *Petrochirus diogenes* summarizes the morphological features of the zoeae and glaucothoës as presently known, and offers some limited ecological data derived from the rearing experiments.

"The Atlantic Coast Surf Clam - with a partial bibliography," by Robert M. Yancey and Walter R. Welch, Fish and Wildlife Service, Dept. of the Interior, Cir. 288, 1968, 14 pp., illus. Available free from Branch of Reports, Publications Unit, BCF, 1801 N. Moore St., Arlington, Va. 22209. The surf clam supports an important commercial fishery along the Middle Atlantic coasts. This pamphlet summarizes the fishery's history, biology, commercial handling, processing, and marketing.

"Shell Opening by Crabs of the Genus *Calappa*," by John B. Shoup, article, "Science," May 24, 1968, vol. 160, no. 3830, pp. 887-89, illus. Decapod crustaceans of various groups open mollusk shells to feed on the soft parts. The most refined shell opening mechanism yet discovered has been found in oxystomatous crabs of the subfamily Calappinae. The article is illustrated with some remarkable photographs.

"Pontellid Copepods as Indicators of an Oceanic Incursion Over Georges Bank," by Kenneth Sherman and Everett Schaner, "Ecology," Spring 1968, vol. 49, no. 3 pp. 582-84 illus. Warm surface water has been observed at various times over the southern part of Georges Bank. Previous studies have shown that pontellids are abundant in the surface waters, and that several species are limited to discrete types of water. To supplement physical oceanographic data on the movements of the warm waters, and to delineate the region of faunal change between coastal and oceanic waters, the authors have examined the distribution of pontellid copepods collected during one of these incursions.

--Barbara Lundy





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| 81 .. Buys Trawlers from Poland                                | 94 .. BOOKS  |
| <b>Greece:</b>   |  |
| 81 .. Fishing Industry Has Problems                            |  |



Created in 1849, the Department of the Interior—America's Department of Natural Resources—is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States—now and in the future.

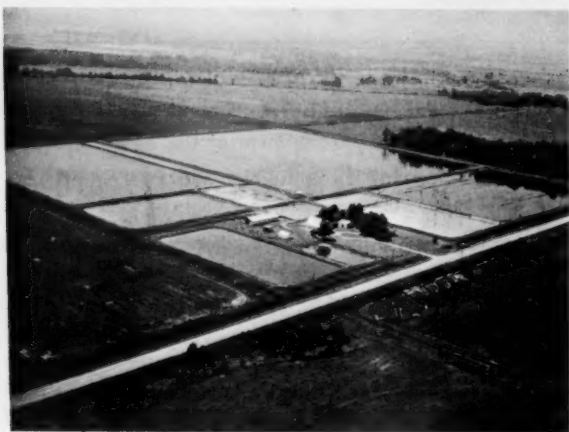


UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. FISH AND WILDLIFE SERVICE  
BUREAU OF COMMERCIAL FISHERIES



# Catfish Farming



## A Growing Industry

A developing and potentially profitable segment of the fishing industry is the commercial rearing of catfish. During the past two years, thousands of new acres have been developed for production of channel, blue, and white catfish. The Department of the Interior's Bureau of Commercial Fisheries is cooperating with the catfish farming industry in an attempt to help the industry realize its full potential.

One of the Bureau's primary objectives is to improve and modernize harvesting. Research has led to development of a mechanized haul seine to harvest catfish effectively. This process enables the fish farmer to remove several thousand pounds of marketable catfish from ponds in a short time and at low cost.

The Bureau is offering technical assistance to those interested in establishing modern processing facilities. At present, the Bureau is providing information on improving layout and sanitation in five new processing plants.

The Bureau is also cooperating in conducting studies which will help the industry to define market for farm-raised catfish.



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